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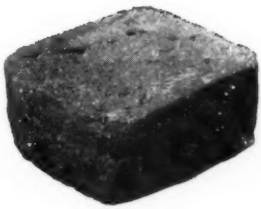

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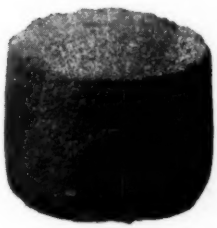

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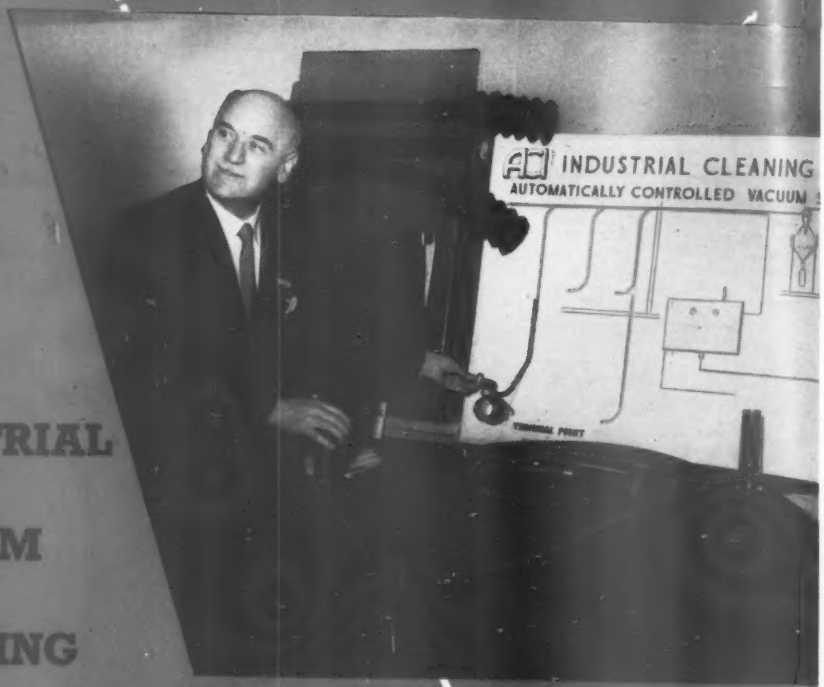

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Automation

This coined word is said to be an abbreviation of a still uglier word automatization. Its implication is by no means established. By some, it is thought to mean inter-operation transfer, others deem it to be any self-regulating mechanism, whilst many associate it with an extended use of electronic control. Whatever be in one's mind, it is nothing more or less than intensive mechanization or using a still earlier word—rationalization. For the foundry industry, there is nothing revolutionary about the implications we have cited. The foundry industry, by its very nature, provides the quickest means of translating a design into a finished article. As an industry, it has not always been quick to take advantage of new developments, but since the last war its efforts in this direction have been particularly praiseworthy. There still remains, however, the problem of instilling the same degree of endeavour amongst the smallest constituents of the industry.

When the moulding machine first appeared in the foundry, it merely eliminated hand ramming. Then a length of roller conveyor cut out the carrying of heavy boxes. Next, a continuous overhead supply of sand obviated the need for shovelling, whilst automatic transfer of rammed moulds from the machine to a conveyor system was the obvious complement. When cast-up, a conveyor from that system to the knock-out point did away with the bulk of the heavy lifting. The latest stage has been reached by replacing lever-pulling on the machines by press-button control. The last phase which remains to be tackled is the automatic replacement of the empty moulding boxes from the knock-out grid back on the conveyor system and the taking away of the hot castings so released.

If this is not a good example of rational evolution we confess to ignorance of the meaning of the phrase. There being no reason for imagining that the mechanized foundry plants have reached the zenith of perfection, then this process of evolution will continue for those castings lending themselves to quantity production. For this country, the large founding concerns can be relied upon to take advantage of any promising manufacturing development. Important as this is, it is not so potent in its impact as the general attitude towards labour-aiding devices by the smaller concerns. In some cases—an outstanding one being in brassfounding—simple mechanizations have produced outstanding increases in the annual production returns. Of all the words that have been coined to symbolize manufacturing efficiency, we like automation the least and have a distinct preference for rationalization, as it is wider in its significance, even though it is too much of a "mouthful."

ABBF/Advisory Service Meetings

On Tuesday of last week at the Clarendon Restaurant, Hammersmith, there were meetings of London-area members of the Association of Bronze and Brass-founders (morning) and of London non-ferrous founders, generally, in the afternoon—the latter in connection with the "Conditional Aid" Advisory Service scheme, which the ABBF is administering. Mr. W. R. Buxton took the chair at both meetings; attendance was excellent. One of the chief items reported by Mr. L. H. Cleaver, for the secretaries, was that the co-operation with the British Non-Ferrous Metals Research Association on shell moulding was to continue, and that Mr. Rice (of BNFMRA) would be issuing a second report on this subject. A new development was that research work on the CO_2 Process, for the benefit of non-ferrous founders in particular, was being arranged with the Research Association, in a similar manner to that on shell moulding.

At the afternoon meeting, Mr. A. Talbot first presented a film taken at his foundry on the CO_2 Process, and commented on various aspects of this new technique as they affect jobbing founders. This meeting was attended by about 75 foundrymen and a very lively "question time" was evidence of the enthusiastic interest invoked by Mr. Talbot's exposition of the process. When closing the meeting, Mr. Buxton intimated that a future gathering, on similar lines, would be held on September 27—general support was given to the proposal that this should concern costing for jobbing founders.

S.-g. Iron

Two hundred foundrymen from all parts of the world are to discuss spheroidal-graphite iron. The proceedings, which are to be held at the Birmingham Chamber of Commerce, will be translated into four languages simultaneously. The programme includes an inspection of the works of S. Russell & Sons, Leicester, and Lloyds (Burton), Limited, of Burton-on-Trent, two prominent British producers of s.-g. iron. A visit will be paid to the research laboratory of the Mond Nickel Company, Limited, to see work in progress. The party will also attend the exhibition of s.-g. iron which is being staged at the Engineering Centre, Stephenson Place, Birmingham. Previous meetings of delegates of s.-g. iron licensees have been held at Brussels, Atlantic City, Paris and Florence.

Glenfield Modernization

In the past year a sum approaching £750,000 has been spent bringing the works of Glenfield & Kennedy, Limited, Kilmarnock, up to date. Among the improvements made have been the mechanization of the light foundry, reorganization of the light engineering shop, building of a new loading bay, extension of the despatch department and the heavy engineering shop, provision of baths in the foundry and the introduction of an apprentice training school. The last instalment in this huge programme is the building of a new brass foundry which is estimated to cost £47,000.

THE APRIL MEETING of the Australian (Victoria) branch of the Institute of British Foundrymen was addressed by Mr. A. W. Lowden, one of HM factory inspectors. His subject was "Industrial Legislation" and the lecturer outlined the responsibilities of foundry executives with respect to securing compliance with the State regulations.

Film Review

To Shape Tomorrow. Sponsored by Bakelite Limited and produced by Cecil Musk in association with Film Producers Guild Limited, this film is available in 35- and 16-mm. colour versions. It runs for 27 min.; applications for loan should be made to the publicity department, Bakelite Limited, 12/18, Grosvenor Gardens, London, S.W.1.

This frankly advertising film shows the extent to which plastics have permeated into every phase of present-day existence. It uses the dual scheme of Mr. Everyman in his home, from the moment of waking to his leaving for the office, picking out the points at which he encounters items made of plastics and then taking the viewer off the "set" into the works for shots of manufacturing processes of several of the less obvious items. In this analogy, the way in which a foundry shell mould—bonded by the firm's resins—is used for making such items as the cast gas-ring which heats Mr. Everyman's morning kettle is well developed. In fact, the shots of shell-moulding taken with the collaboration of Fairbairn, Lawson, Combe, Barbour, Limited, almost "steal the show." Other products of the sponsoring firm—Vybak plastics, polyester resins reinforced with glass fibre (showing extraordinary impact resistance) and Warerite decorative plastics (for such items as canteen table tops) complete the main subject matter.

The whole film is well-balanced and should well perform the functions desired, besides indicating to the general public the importance of foundries in the general scheme of things and—for a wonder—depicting a clean, orderly foundry using a modern, highly photogenic process.

Technical Courses in Furnace Brickwork

The City and Guilds of London Institute has prepared a two-year part-time final grade course in furnace brickwork, which is intended for journeymen and apprentice bricklayers whose work is largely concerned with refractory and other brickwork in connection with the construction, maintenance and repair of furnaces, kilns and retorts and their ancillary structures. Students entering for the course will normally be expected to have successfully completed the intermediate stage of the Institute's course in brickwork, or a course of equivalent standard. The scheme will come into operation in the college session 1955/56 and the first examination will be held in 1956. Full particulars of the course can be obtained from the City and Guilds of London Institute, Department of Technology, Gresham College, Basinghall Street, London, E.C.2 (price 6d.).

Latest Foundry Statistics

As reported by the British Bureau of Non-Ferrous Metals Statistics the output of bronze and brass castings during April was 5,136 tons. In the first months of the year the total was 20,594 tons as against 21,187 during the corresponding period of last year.

According to the Ministry of Supply the output of aluminium castings during March was 8,393 tons, made up of 1,914 as sand cast, 4,760 as gravity-die and 1,719 tons as pressure-die castings.

THE OFFER of Vickers, Limited, to acquire 1,011,603 ordinary 10s. shares in Powers-Samas Accounting Machines, Limited, in exchange for ordinary shares has now become unconditional.

Birthday Honours

Awards to many people associated with the foundry, iron and steel, and allied industries were announced in the Birthday Honours List, which was published last week.

Details of some of the principal awards and biographical notes on the recipients are given in what follows:—

BARONS

MR. RALPH ASSHETON, MP for the Rushcliffe Division, 1934-45, City of London, 1945-50, and Blackburn West 1950-55, who was Parliamentary Secretary to the Ministry of Labour and National Service from 1939 to 1942. Mr. Assheton was Parliamentary Secretary to the Ministry of Supply from 1942 to 1943 and Financial Secretary to the Treasury, 1943-44. He has served as a director of many finance companies, including the Finance Corporation for Industry, Limited. His award has been made for political and public services.

SIR GEOFFREY HEYWORTH, chairman of Unilever, Limited, for public services. Sir Geoffrey was a member of the Royal Commission on Taxation of Profits and Income set up in 1951 and which published its final report last week. He was a member of the Company Law Amendment Committee of the Board of Trade in 1943 and was appointed chairman of the Gas Industry Committee in 1945.

PRIVY COUNCILLOR

MR. HENRY BROOKE, MP for West Lewisham from 1938 to 1945 and for Hampstead since 1950. He has been Financial Secretary to the Treasury since 1954. From 1938 to 1945 he was deputy chairman of the Southern Railway Company.

BARONET

SIR GEORGE HORATIO NELSON, chairman and managing director of the English Electric Company, Limited, and chairman of D. Napier & Sons, Limited, the west London aero-engine makers, Marconi's Wireless Telegraph Company, Limited, and other companies. He was president of the Federation of British Industries for two years in succession from 1943 to 1945 and was president of the British Electrical and Allied Manufacturers' Association in 1950. In 1942 he went to the United States and Canada as head of the United Kingdom Tank Commission.

Sir George has served on numerous committees, the more recent of these including that on the future of scientific policy in 1945, the Census of Production Committee, of which he was chairman, in 1945, and the general board and executive committee of the National Physical Laboratory for six years from 1945 to 1951.

KNIGHTS BACHELOR

MR. JOHN CARMICHAEL DENHOLM, immediate past-president of the Chamber of Shipping of the United Kingdom.

MR. ALBERT WILLIAM GRANT, chairman of the Engineering and Allied Employers' West of England Association.

WING-CMDR. NORMAN JOHN HULBERT, MP for Stockport from 1935 to 1950 and for North Stockport since 1950, for political and public services. Wing-Cmdr. Hulbert has served as a director of the British Thomson-Houston Export Company, Limited; the Metropolitan-Vickers Electrical Export Company, Limited; Westland Aircraft, Limited, and other companies.

MR. ROBERT M. SHONE became an executive member of the Iron and Steel Board in May, 1953, when he was appointed one of three full-time members of the Board. On joining the Iron and Steel Board Mr. Shone ended an association of about 18 years with the British Iron and Steel Federation. Much of this time was spent in the statistics and economics department, which he joined in 1936.

Mr. Shone took a first-class honours degree in engineering at the University of Liverpool, following which he was awarded a Commonwealth Fellowship to the United States, where he worked at Harvard and Chicago, obtaining an MA in economics. On his return from America Mr. Shone lectured for a year at the London School of Economics before joining the British Iron and Steel Federation. He was awarded the CBE in the 1949 Birthday Honours.

MR. JAMES MILLARD TUCKER, vice-chairman of the Royal Commission on Taxation of Profits and Income.

MR. HUGH EDMUND WATTS, lately HM Inspector of Explosives, Home Office.

ORDER OF THE BATH
Civil Division
CB

MR. REGINALD JOHN AYRES, accountant general, Ministry of Fuel and Power.

MR. GEORGE WILLIAM HOGGAN GARDNER Director-General of Technical Development (Air), Ministry of Supply.

ORDER OF ST. MICHAEL AND ST. GEORGE
CMG

MR. WALTER ERNEST KNOX, secretary to the Exports Credits Guarantee Department.

ORDER OF THE BRITISH EMPIRE
Civil Division
GBE

SIR WILLIAM ROOTES, chairman of the Rootes Group and of the Dollar Exports Council. Sir William has served on many committees including the council of the Society of Motor Manufacturers and Traders, the National Advisory Council for the Motor Manufacturing Industry, and the Engineering Advisory Council of the Ministry of Supply. Sir William was chairman of the Supply Council at the Ministry of Supply from 1941 to 1942, and a member of the Board of Trade Advisory Council from 1931 to 1934 and from 1939 to 1940.

KBE

DR. ALEXANDER FLECK, chairman of Imperial

Birthday Honours

Chemical Industries, Limited, with which firm he has been associated since 1917. He was appointed to the board of the company in 1944, was elected deputy chairman in 1950, and succeeded Mr. John Rogers as chairman in 1953.

C.B.E.

MAJOR C. R. DIBBEN, chairman of the Midland Regional Board for Industry. He is a director of J. Brockhouse & Company, Limited, founders, axle manufacturers, etc., of West Bromwich, and a director of the group's subsidiary companies. MR. J. V. DUNWORTH, head of the reactor physics division of the Atomic Energy Research Establishment at Harwell; MR. C. H. DUTTON, vice-chairman of Rotax, Limited, aircraft electrical engineers, of London, N.W.10. DR. G. E. FOXWELL, consulting fuel technologist, who has conducted lengthy research into the coking of coal. He is a former president of the Institute of Fuel. MR. R. W. L. GAWN, Assistant Director of Naval Construction, and Superintendent of the Admiralty Experimental Works at Haslar; MR. G. H. HOULDEN, managing director of the shipbuilding division of Vickers-Armstrongs, Limited; MR. C. E. LUCETTE, manager and secretary of the Manchester Ship Canal Company; MR. D. D. PRATT, director of the chemical research laboratory of the Department of Scientific and Industrial Research. MR. H. P. R. SCOTT, joint managing director of Summersons Foundries, Limited, and Thomas Summerson & Sons, Limited, railway plant engineers, of Darlington. He is managing director of the Copelaw Engineering Company, Limited, and a director of F. H. Lloyd & Company, Limited, steelfounders, of Wednesbury (Staffs), and other companies. MR. H. G. TAYLOR, chairman of B. & S. Massey, Limited, and a director of Modern Machine Tools, Limited; MR. J. L. THOMSON, Professor of Mechanical Engineering at the Royal Military College of Science, Shrivenham; MR. J. N. TOOTHILL, general manager of Ferranti, Limited, manufacturing electrical engineers, Edinburgh works.

O.B.E.

MR. R. V. ATKINSON, works director of the Gloster Aircraft Company, Limited; MR. E. S. BLAKE, vice-chairman of the Eastern Regional Board for Industry. MR. J. D'A. GLANVILLE, deputy chief engineer, industrial group, United Kingdom Atomic Energy Authority; MR. R. E. L. LOVELL, technical director of Vosper, Limited, shipbuilders and engineers, of Portsmouth; MR. J. B. MCNEE, a director and general manager of Barclay, Curle & Company, Limited, shipbuilders, of Glasgow; MR. R. A. P. MORGAN, superintendent, Royal Ordnance Factory, Birtley (Co. Durham); MR. L. A. PAYNE, a director and manager of Cooke, Troughton & Simms, Limited.

M.B.E.

MR. ELI AYLAND, works manager, engineering division, of John Curran, Limited, Cardiff; MR. W. S. BATES, a director and secretary of Philip & Son, Limited, engineers and shipbuilders, of Dartmouth (Devon); MR. RALPH BEAL, chief marine superintendent of William Cory & Son, Limited; MR. W. G. BENNETT, works manager of the Climax Rock Drill & Engineering Works, Limited, Redruth (Cornwall); MR. J. M. BOYD, chief switch designer of the Electric Construction Company, Limited, Wolverhampton; MR. HUGH BROWN, engineering chief draughtsman of Harland & Wolff, Limited, Belfast; MR. H. G. CHEEL, general manager, the General Electric Company, Limited, Wembley (Middx); MR. HERBERT CRUMP, works manager in the engineering and shell division of Beans Industries, Limited, engineers and ironfounders; MR. KEMP DAY, leading draughtsman of John I. Thornycroft & Company, Limited, engineers and shipbuilders, of Southampton; MR. J. W. E. GARDNER, chief new development and process engineer, of D. Napier & Son, Limited; MR. H. P. HALE, senior experimental officer, low-temperature research station, Department of Scientific and Industrial Research; MR. JAMES HUTTON, fitting and assembly shop superintendent, Albion Motors, Limited, Scotstoun, Glasgow; MR. HEDLEY LLOYD, a director and supervisory export manager, of Marsh Bros. & Company, Limited, alloy steelmakers, etc., of Sheffield; MR. H. H. NEWELL, superintendent of the rehabilitation workshop of Vauxhall Motors, Limited, Luton; MR. JOHN PATERSON, works manager of the Winsor Engineering Company, Limited, Glasgow; MR. GEORGE REEVES, area organizer for the United Patternmakers' Association; MR. F. S. SALTER, chief designer, hydraulic department, Loewy Engineering Company, Limited, Poole (Dorset); MR. W. A. SMITHDALE, lately shop superintendent of Rolls-Royce, Limited, Birmingham; MR. W. C. STYAN, engineer-designer, Vickers-Armstrongs, Limited, Crayford (Kent); MR. G. H. TODD, shipyard manager, Hawthorn Leslie (Shipbuilders), Limited, Hebburn-on-Tyne (Co. Durham); MR. P. E. VIDLER, deputy secretary, Birmingham Chamber of Commerce.

British Empire Medal

MR. G. T. ALLEN, foreman fitter, British Aluminium Company, Limited, Falkirk; Mr. W. J. ARKINSTALL, millwrights foreman, Universal Grinding Wheel Company, Limited, Stafford; MR. A. C. BAGNALL, welfare assistant, Steel, Peach & Tozer (branch of the United Steel Companies, Limited), Rotherham; MR. D. F. BALL, chief inspector, Kirkstall Forge Engineering, Limited, Leeds; MR. BERNARD BOAM, brickmaker, Butterley Company, Limited, Ripley (Derbyshire); MR. W. C. CASEY, foreman shipwright, Cardiff Channel Dry Docks & Pontoon Company, Limited, Cardiff; MR. P. W. CHARLES, general foreman, De Havilland Engine Company, Limited, Stanmore (Middx); MR. WILLIAM FAIRHURST, foreman, Electronic Tubes, Limited, High Wycombe (Bucks); MR. A. S. W. FENWICK, head foreman shipwright, John I. Thornycroft & Company, Limited, Southampton; MR. GEORGE HORSLEY, laboratory mechanic, Admiralty Fuel Experimental Station, Haslar (Hants); MR. W. C. JOUHNING, Geological Survey and Museum Department of Scientific and Industrial Research; MR. NORMAN MALLINSON, general foreman, Samuel Wilkinson & Sons, Limited; MR. JAMES MORRISON, head foreman plumber, Harland & Wolff, Limited, Belfast; MR. WILLIAM RICHARDSON, senior blacksmith, Birtley Company, Limited, Birtley (Co. Durham); MR. JABEZ ROSTANCE, shop foreman and maintenance engineer, John Jardine, Limited; MR. S. A. ROWLEY, foreman, Newton Bros. (Derby), Limited; MR. T. W. SPENCER, quarry engineering worker, Derbyshire Stone, Limited, Matlock; MR. JAMES SWAN, foreman and development manager, George MacLellan & Company, Limited; MR. CHARLES TAYLOR, head loftsman, Blyth Dry Docks & Shipbuilding Company, Limited; MR. J. W. WEBB, superintendent of ambulance room, Firth-Vickers Stainless Steels, Limited, Sheffield.

MR. STANLEY VAUGHAN has been elected president of the Institution of Structural Engineers for the session 1955-56.

Aspects of Steelfoundry Practice*

By H. Hart

(*Continued from page* 620)

Atmospheric Cores

Atmospheric or "cracker" cores are usually placed in blind risers and their function is termed as: "To introduce atmospheric pressure into the riser." In an effort to determine the principles of this introduction, an oil-sand core 3-in. long, ⅝-in. dia., was fixed in a steel tube of the same diameter with half of the core protruding from the tube, as in Fig. 16. This assembly was placed in a blind riser, so that the metal would seal around the steel tube. A rubber bung with a central hole was fixed into the other end of the steel tube, with a glass tube of "U" shape coming through the hole. Coloured water was placed in the bottom of the U-tube to observe what pressure change took place between riser and atmosphere. In the initial stages, gas was ejected rapidly and took flame on the tube outlet ; this flame was maintained for 2 to 3 min. after casting. Gas continued to pass through the water at a steady flow for another 2 to 3 min., then gradually diminished in volume. It then came in spasms in a puffing action for up to and sometimes over ten min. from the time that casting took place. Riser solidification was assumed to be complete inside that period

The deductions were that no atmospheric air permeated through the core to the riser, and that riser vacuum was avoided by the generated gases from the core entering into the void, with the excess being ejected to atmosphere. When the gases were coming out steadily and regularly, the water was out of balance by being further up one leg of the U-tube than the other. Eventually, however, it found its own level as pressure diminished. Several tests of this type all gave the same indications.

It can be presumed that pressure arises from the core, and the core also functions as a medium between riser and atmosphere for the equalization of pressure, which eventually balances at 14.7 lb. per sq. in. The phrase which is usually coined in descriptions of so-called "cracker" cores, of "admitting atmospheric pressure," although true in a sense, is misinformative, as the pressure unit, which is the core, is already in the riser, only awaiting action by the presence of liquid metal.

The true sense of admitting atmospheric pressure is the case where vees or wedges are used on the outside of a riser for this purpose. Fig. 17 shows a selection of risers, where atmospheric pressure was admitted by means of a wedge. Various designs of vees, etc., have been tried, and this type of wedge has been found most successful—so much so, that alteration has already been carried out on 50 per cent. of the risers in the machine-moulding section of the foundry from the use of a core to a wedge. The advantages are:—

(1) The wedge shape is made with the mould.
(2) It is not necessary to make separate "atmospheric" cores.
(3) No fixing of cores in the riser is required.
(4) There is no disturbance of sand, as in the fixing of a core.
(5) On small risers, the problem where it is difficult for a moulder to insert his hand for core fixing does not arise.
(6) The wedge is also more economical.

Partial Reversal

Partial reversal of moulds involves placing the centre of the moulding box on a pivot, so that it is located near its point of balance to facilitate easy tipping in either direction. This system of partial reversal has several assets over conventional foundry practice and its value and purpose have been recorded in relation to the feeding of steel castings, but in shop-floor practice, advantages are also being obtained in other directions. In the meantime, however, priority will be given to its use in feeding practice. It is not every casting by any means that is suitable for the partial reversal technique but on the other hand many castings can be adapted for using the process with beneficial results. Numerous occasions arise in using partial reversal, whereby a casting can be fed satisfactorily by one riser, when conventional foundry practice would call for several; therefore, in feeding practice alone the advantages are obvious. Reduction in "head" metal, thus increasing yield per cent. and also reducing cutting and grinding costs, enabling commercially sound castings to be produced on an easier and more economical basis, are other advantages.

Fig. 18 shows the simplest example of using partial reversal; it is a levelling-block casting, having an even metal section throughout. The riser and runner are placed at the same end of the casting and when pouring these are in the lower position. Immediately after casting the box is tipped over in the opposite direction so that the head and runner are then uppermost. The casting weighs 5¼ cwt.; the riser is a 10-in. sphere and the yield is about 83 per cent. Controlled directional solidification towards the riser are the primary requirements for efficient feeding. These are established principles that are well known and understood, and with partial reversal, the potentialities of a perfect temperature-gradient being developed are very favourable, a very important factor in producing sound castings.

It could be argued that the required temperature gradient would have been obtained with the riser

* Paper read before the Scottish branch of the Institute of British Foundrymen. The Author is on the staff of the National Steel Foundry (1914) Limited.

Aspects of Steelfoundry Practice

and runner so placed and the job poured on the flat, but Fig. 19 shows the two methods, with approximately an equal volume of metal poured. With the partial reversal method, in the pouring position it must be apparent that the mould has already started to heat up at its maximum rate in the vicinity of the riser whilst the other half of the mould is only being subjected to radiation. The mould on the flat has begun to be heated throughout its length by the metal, while the cope or top part, which includes the riser, has the effect of radiation only. When the moulds are finally poured, a suitable temperature-gradient could be set up by casting on the flat, but by partial reversal it must be conceded that a more pronounced temperature-gradient must be set up. Also, when the angle of pouring is the reverse of the angle of feeding, the further inducement of gravity and ferro-static pressure comes to bear on the feeding of the casting.

Fig. 20 shows a door casting that was made in a similar manner using the partial reversal methods.

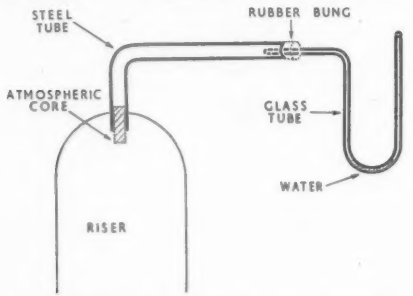


FIG. 16.—*Experimental set-up to determine the principles of atmospheric pressure with a core.*

Its weight was 15½ cwt.; the riser a 12-in. sphere, and the yield 90 per cent. This illustrates that a casting of quite large dimensions can be successfully made, by using one feeding head. A number of these castings was made by this method and the drilling of holes in the machining process was extensive and indicated soundness throughout. A large tyre-mould of which several were required was cast successfully using the same general technique, only in this instance two heads were required. Fig. 21 illustrates the pattern for the tyre-mould showing its size and design. The other side is perfectly flat and it was cast with the flat-side uppermost. A rib was placed in the pattern in front of the runner connecting the heavy sections. This allowed the metal to be distributed and have an even upward flow on both sides of the raised portion of the mould in the early stages of pouring. The rib was later removed in the dressing shop. Fig. 22 shows the method of running and "heading" this particular casting. The "male" tyre mould casting weighed 30½ cwt., and carried riser spheres of 12½- and 10½-in. dia. giving a yield of 91 per cent. The female part of the mould weighed 26¼ cwt., used spherical risers of the same size as the other part, and gave a yield of 88 per cent.

FIG. 17.—*A group of atmospheric risers.*

Fig. 23 shows at (*a*) a wheel with a centre hub that has a very awkward design as far as feeding is concerned. Access to the heavy-junction hot-spot is usually attained by padding in the centre core, a procedure which necessitates excessive cutting and grinding for removal of the padding. This type of wheel is normally cast with two or four heads on the rim and one on the centre boss as in (*b*) and (*c*). A unique method of padding was later adopted and by partial-reversal this casting was made with one side-head only.

Fig. 24 is a sectional sketch showing the padding connected through from the outside rim to the heavy-section hot-spot in the centre boss. A flat core, ⅛ in. thick, with a 15 per cent. zircon sand addition separated the padding from the wheel plate. The cutting required to separate the padding from the casting and the grinding operation to bring the casting back to its true shape were simplified considerably. Fig. 25 illustrates the pattern, showing the padding to the centre boss. The casting weighed 12¾ cwt. and with risers 9 in. dia. and 14 in. high the yield was 88 per cent.

FIG. 18.—*Example of casting by partial reversal* (*see also Fig.* 19).

To-day, it is common practice to cast moulds on a bank with the runner at the lower end, and the riser situated furthest away from the runner, at the top end of the box. It must be evident that a proper temperature-gradient does not exist with this method of casting. This may be countered by saying that good castings are made in this manner. Such may be true, but it would be more appropriate to say that satisfactory castings are made by this method, and that better castings would be the result of placing runner and riser together and reversing in the manner described.

Semi-partial-reversal

A further method, which may be termed semi-partial-reversal, is only of benefit in running castings. The castings are run in exactly the same manner as with the partial-reversal method, then they are tipped back to a level position. This is of value on the many occasions when the most suitable method to feed a casting is from a level position, but the level position is not the most suitable manner of running it. This situation arises, usually, with castings of flat or near-flat surfaces

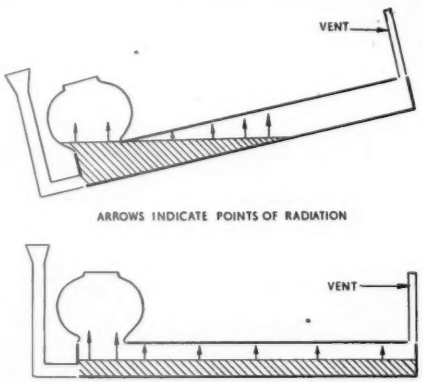


FIG. 19.—*Diagram of the flat and partial-reversal methods of casting.*

with intermittent heavier sections, which require several risers at different locations on the casting.

A feature of the system of running uphill is that the metal collects in the lower portion of the mould (as was shown in Fig. 19, in partial reversal) to fill the mould in bulk formation. In this manner it brings higher metal pressure to bear where gas is being generated, thereby ensuring that the metal will lie quietly on the mould face, whereas in flat casting, gases generated at the mould/metal interface, usually cause a bubbling action. This condition is usually associated with a number of indentations on the casting surface, caused by gases pushing into the "plastic" surface metal when metal pressure was low in the early stages of pouring.

Another beneficial point of this method is the reduced period of radiation; heat radiation from

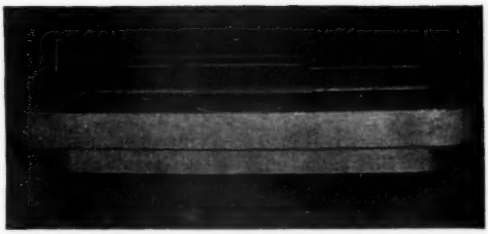


FIG. 20.—*Door casting made by partial reversal.*

molten metal within a partly-filled mould is the cause of sand spalling or being drawn down from above. This inconvenience is curtailed by casting the mould on a pivot, as radiation of the top part only occurs in stages, therefore the sand is not subjected to such rigours as it is when casting flat. Also there is no risk of entrapping air, as exists when metal rises to meet a flat top, because in casting in a tipped position all the gases are directed to the highest part of the mould where they can be released by adequate venting. After these reduced risks are secured in the pouring operation, in the method of semi-partial-reversal, the box is then tipped to a level position for feeding to take place.

Dry-sand Moulds

There are many factors where vigilance and control have to be exercised in the constant aim to produce sound clean castings. For example, first-class moulds can give faulty castings should they be allowed to stand for too long a period after stoving. Fig. 26 illustrates what happens to a silica/cereal/bentonite bonded sand after an eight-day period of exposure to shop-atmospheric conditions. A number of dried, standard test-pieces were placed in the foundry. Three were taken daily and the average moisture and compression plotted on a graph. Strength falls along with a moisture pick up, and it is reasonable to assume that the actual surface layer of facing sand will be affected in a more pronounced manner than that indicated by

FIG. 21.—*Pattern for a tyre-mould casting.*

Aspects of Steelfoundry Practice

the test-pieces. This weakening effect, with moisture in the surface facing sand does tend to encourage scabbed and dirty castings. It is policy, therefore, to store dry-sand moulds and cast in strict rotation after stoving, before deterioration of the sand goes too far, because of such changes that can take place.

Scabs

Scabs are more prevalent on horizontal surfaces of castings than on any other plane. Varied opinions are expressed on how they occur.

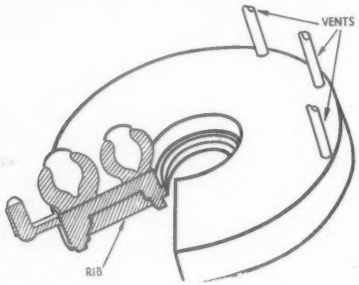


FIG. 22.—*Method of running and gating the tyre-mould casting.*

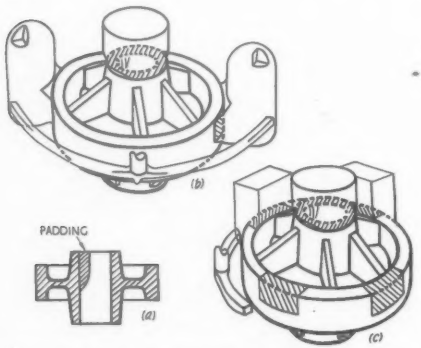


FIG. 23.—*Method of producing an awkward wheel casting.*

Buchanan[4] says that expansion and contraction of the sand are not the direct cause of scabs, and that they are the result of steam pressure pushing the sand into the metal. According to Hudson[5] and Dietert[6] the direct cause of a scab is the high contraction of the sand, causing cracks to open on the face of the mould, into which molten metal penetrates. The backing sand being at a lower temperature expands and tends to push the facing sand into the metal.

Gases and steam generated during casting, load up the pore space of the sand and, depending on the rate of evolution in relationship to the permeability, they may eventually come under pressure. The height of the metal during pouring is the determining factor on metal pressure in the various parts of the mould at the various stages of pouring. Moulds and cores will only "blow" when gas pressure exceeds metal pressure; this also applies to scabs. When metal spreads itself over a flat surface, any gases generated in excess of metal pressure will pass through the liquid metal with a bubbling action until an impervious, semi-solidified shell of metal forms at the mould face.

When liquid steel comes into contact with moulds and cores, the chilling action of the sand on the metal develops a skin formation very rapidly, except in the runner locality (where cooling is retarded by the incoming hot metal). The permeability of the sand has then to cope with all the gases and steam generated below this shell. When the pressure builds up, this is the point of potential

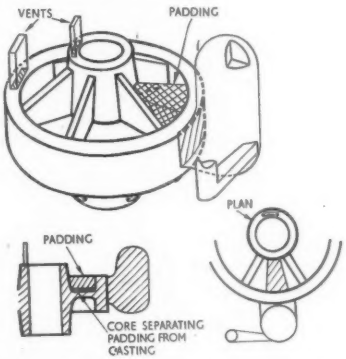


FIG. 24.—*Padding from the outside rim to the heavy cross-section in the centre boss of the wheel casting.*

scabbing, as it appears that a scab does not develop until this semi-solidified shell has formed. The opinion is that pressure comes to bear on the shell and eventually pushes it from its position and it is the shell that is pushed into the metal, the sand immediately below it goes in with it, as in Fig. 27 (*a*) until the shell ruptures.

When a scab is of thin formation it is the sintered sand, that may, or may not, be adherent to the shell, that has parted from the main body of sand and together they go into the metal. Observations contingent on a scab taking place show that when the shell is ruptured a gas release takes place which erupts through the liquid metal as in Fig. 27 (*b*), bringing with it other loose sand which floats off to become entrapped in various parts of the casting. Immediately this has taken place, the liquid metal flows back through and under the ruptured shell and its adherent sand into the void created by the upheaval, thereby trapping a layer of sand between the parent metal and the void metal as in Fig. 27 (*c*). This void metal is also trapped between the still adherent sand and the main body of sand and depending on

what type of shell rupture has taken place in the scab formation this metal can often be levered out of its position by means of a pointed bar. The section at (*d*) is of a scab as seen on the casting.

Scabbing Potential

Fig. 28 shows how a casting of the design shown has four potential scabbing surfaces in A, B, C and D and indicates the approximate metal height when scabbing is very liable to take place, owing to the low metal pressure exerted at these periods during the pouring operations. On the left of the sketch is an indication of pouring time as the metal rises in the mould, and, as shown, the flat sections take longer to fill up in relation to other sections of the casting.

To minimize the risk of scabbing, it is essential to fill up the flat sections quickly in order to develop adequate metal pressure to combat gas pressure and it is good policy to keep the pouring-time line as straight as possible with this end in view. To avoid scabs, the ideal position to pour the casting sketched would be in the manner as shown at (*b*) Fig. 28. In this position, there are no potential scabbing surfaces due to metal pressure combating gas pressure throughout the pouring period. However, it is agreed that the example is not too practical in its application.

Fig. 28 at (*c*) shows a practical proposition of casting on a pivot and retaining the quality of metal pressure, thereby curtailing immensely the risk of scabbing during the pouring operation, then tilting either to a flat position or reverse as required, for feeding purposes.

This is yet another asset of the technique of casting on a pivot and tilting. May it be emphasized, therefore, that creating and taking advantage of metal pressure which this technique provides is beneficial in many respects in the constant aim to produce clean sound castings.

Core Scabs

When scabbing occurs on an oil-sand core, such defects are generally of thin formation, also they tend to form on upper surfaces and their cause can usually be attributed to the core-paint, when the following conditions arise:—

(*a*) Improper mixing of paint; (*b*) the paint, due to its settling action in its container is being used without being re-stirred; (*c*) applying paint to a core with a burnt or scorched surface, and (*d*) improper drying out of the paint after its application. Should water from the paint find its way into the core—which can happen when conditions (*a*) and (*b*) arise—it more or less destroys the core-binding agents to the depth of its penetration. In the case of (*c*), on a burnt or scorched surface the binding agents are already destroyed, or considerably weakened depending on the extent of over baking, and in (*d*) steam has to be contended with as well as core gases.

These conditions in the upper surfaces of cores are also associated with gas pressure and, curiously enough, these self same conditions are not nearly so detrimental when they exist on a bottom half-core. This is due to the gases in the core being

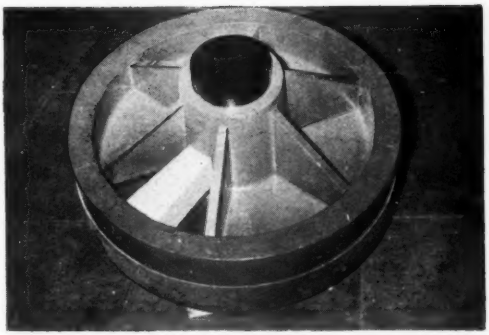


FIG. 25.—*Pattern for the wheel, showing padding to the centre boss.*

directed upwards by the rising metal and released to atmosphere at the core joint. On the top half-core the upward flow of metal continues to direct a fair volume of gas upwards and when the metal eventually flows and skins over the top of the core, these upward moving gases have to be reversed, with the result that a gas pressure develops on the core top-area shell. Should a poorly bonded layer of sand exist here below the paint, by reason of the above conditions, it will yield with the shell very easily, resulting in a scabbed casting.

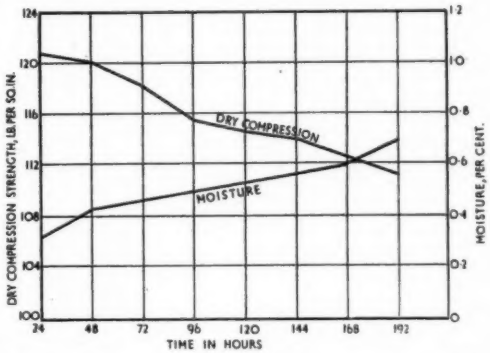


FIG. 26.—*Properties of moulding sand according to time after stoving due to atmospheric conditions.*

Fig. 29 shows a core for a steam-trap casting wherein the metal completely surrounds the core, except for one opening. With this design, at one point during casting the core is completely covered with metal except for a small domed portion at the top. This can be seen unpainted in Fig. 29. The area indicated was very prone to scabbing when it was painted due to the gases that were concentrated in this area. Any fluctuation in paint viscosity along with improper baking resulted in scabbing. Since adopting the practice of not painting the dome of this core, no scabbing whatsoever has taken place.

Aspects of Steelfoundry Practice

There is also a better release of gas through the unpainted area during pouring, so avoiding the same gas concentration as was formerly found in the painted core. Thus, it is good practice to avoid scabs, and this can be done by not painting core sections where gases are liable to be directed by the metal and set up gas pressure, which comes to a critical point when the metal flows over that area and enforces a re-direction of these gases. The possibility of re-directed gases should be avoided where possible to reduce the risk of scabbing as there is no doubt such a phenomenon does create a local excess pressure during the reversing process.

With the core quoted, there is nothing one can do to avoid the occurrence of gas directional change

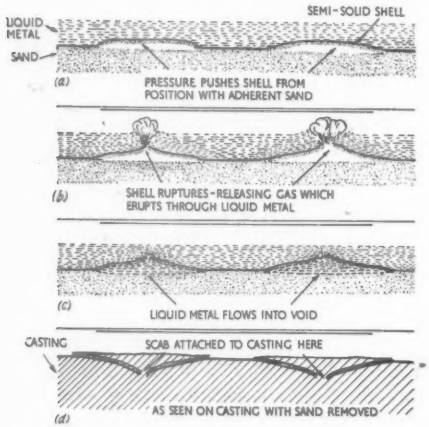


FIG. 27.—*Postulated sequence of scab formation at a casting surface.*

but the risk of defects can be overcome by not painting the parts affected by pressure and using cores of good quality.

There is, however, more scope in varying to advantage the moulding process with various designs so as to avoid excess gas pressure at times when metal pressure is low. The primary consideration in the manufacture of castings is usually to find the easiest way to mould, provided that sufficient risers can be incorporated, and be so placed as to ensure easy removal in the dressing shop. Consideration of manufacture to enable the castings to have an easy, uninterrupted passage through the dressing shop is of great importance.

The benefits of a sensible application of risers, however, are lost if a scab appears with the usual concomitant distribution of loose sand in the casting which often results in its being scrapped, or in extensive rectification. The latter is never satisfactory, because of unseen entrapped sand which usually reveals itself on machining. The main point for consideration is again gases and steam and their liberation during the casting process.

The natural trend of these gases is upwards, which is quite satisfactory when they are on a direct route to atmosphere, but if they come to a "cross roads" and meet with gases coming in another direction, which does happen in casting moulds of inverted "L" sections as in Fig. 30, the consequences may be serious scabbing or a series of small scabs, which are usually located on the fillet area. Fig. 30, at (*a*), shows the metal level when this occurs. It is obvious that a collision of gases takes place at this point. The detrimental factor, however, is the greater volume of mould being filled at that point, thereby effecting a slower rise of the liquid metal in the filling-up process, and resulting in a delayed period for obtaining metal

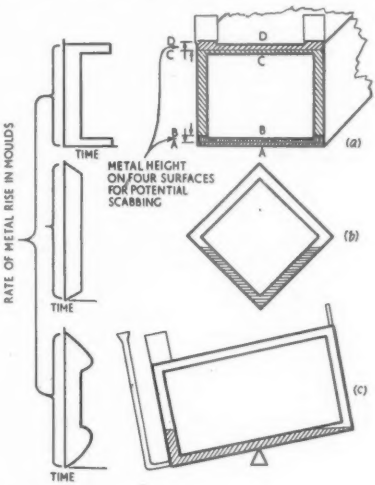


FIG. 28.—*Potential scabbing surfaces and methods for the avoidance of the defect.*

pressure at an area of maximum gas-pressure development.

Fig. 30, at (*b*), shows that in the "L" position the reverse procedure occurs. There is a reduced gas concentration at the fillet and, due to the reduced section volume then being poured, there is a faster development of metal pressure which will very quickly counteract any gas pressure. There are many castings of similar design to those used for examples that to-day are made as in sketch (*a*), Fig. 30, since the method is an easy one for both moulding and feeding, but it has been proved without question, in both green and dry sand, that the technique (*b*) of running a casting from horizontal to perpendicular, as against normal practice of perpendicular to horizontal, is more beneficial. A clean casting results, which has an uninterrupted passage through the dressing shop. The usual criticism when a scab occurs is that the sand was either too weak or too wet, whereas

all the while the individual was an accessory before the fact, for determining that the casting should be made in such a manner as would make it prone to scabbing.

Porosity

Occluded gases in liquid steel are the cause of pinholing in castings, and hydrogen appears to be the chief offender. According to Zapffe and Sims,[7] molten steel must always be considered as having some "threshold" hydrogen that may or may not in itself cause trouble. There are several ways in which this hydrogen can be absorbed into the liquid metal, and even with good melting-practice, with all precautions towards prevention of gas pick-up, the metal comes to the foundry with a varying content of "threshold" hydrogen, which if detrimental will be liberated by its behaviour in the transition of the steel from liquid to the solid state, with the resultant effect of porosity. The reference here is devoted to the behaviour of steel with varying hydrogen content, when poured into moulds.

Fig. 31 shows steels with their "threshold"-hydrogen content and the approximate feeding results to be expected from them. It is possible with steel in category (*a*) to make any type of casting of intricate design. Otherwise, also, one can use faulty running systems that may cause excessive turbulence, with this particular grade of metal and it will not exhibit any signs of porosity whatsoever. A wet mould which causes turbulence, mild or violent, may show extensive blowholes but pinhole porosity will not be evident. This can be attributed to the low "threshold"-hydrogen content of the steel in this category.

To go to the other extreme of the steels shown, this metal, when poured, after a short delay starts to puff-up in the riser as sketched at (*f*), indicating what is known as a porous heat. With the situation of varying degrees of excessive hydrogen content, there are heads that puff-up in full measure, while in other heats the rising is not nearly so pronounced until a point is reached at (*d*) where the metal does not rise but remains stationary at the level cast, indicating that no feeding of the casting has taken place. Next to that in the series is the riser that feeds a little but not to the extent it should do. These situations give rise to porosity of various degrees in the castings.

It is a known fact that temperature influences the amount of metal that passes from the riser for feeding purposes, and a casting with two similar sections risered in the same manner may show a pronounced riser cavity in one, while the other riser farthest away from the runner may show very little cavitation. This condition of cold metal in the risers must not be confused with the points regarding porosity which have been made. Instances have been known where a portion of a cast has been porous while the balance of the castings appear to be free of pinholing. Provided that all the metal was the same and that a portion of it was not altered by faulty ladle drying during the casting process, these occasions of partial porosity

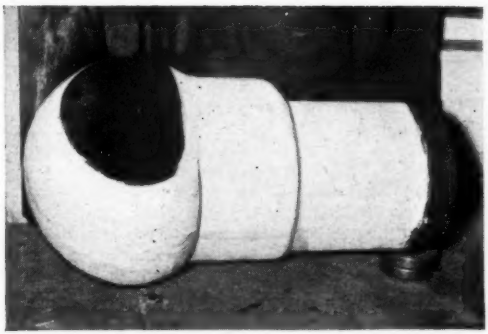


FIG. 29.—*Core for a steam-trap casting.*

can be attributed to different casting conditions in the moulds, either by altered design or inferior moulds or cores which are more inoculative than in others.

The next point of observation is when the head is cut or knocked-off. This operation of head removal is well worth close attention, and the finding of porosity signs can be used to eliminate any more work being done on the castings. It must be remembered that castings fed with blind heads show no

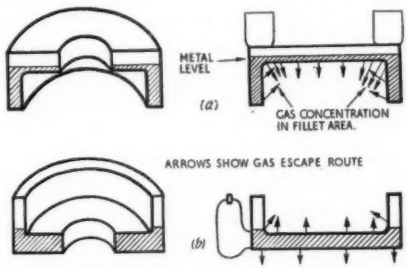


FIG. 30.—*Inversion as a method of reducing gas pressure at a fillet.*

outward sign of porosity until the head has been removed. There may be several large gas holes which are obvious, but the defect could also be a series of small holes with a larger central hole. Small gas holes are either partially or completely obliterated by the cutting operation and the central cavity is often mistaken for shrinkage.

If the method of feeding has already been proved to be satisfactory on previous batches of castings, it can be taken that some porosity exists in the casting concerned. X-ray or gamma-ray examination will confirm this. This type of porous casting is usually discovered after all the operations of dressing, welding the cavity, annealing and shot-blasting have been carried out, and is a cause for rejection at the final inspection. If attention be paid at the cutting operation and the signs observed carefully, this unnecessary work and expense involved can often be avoided.

Aspects of Steelfoundry Practice

Mould and core factors that encourage local porosity seldom show indications in or at the head. Such defects, however, may be noticed at re-entrant angles or not at all, or may only be exposed either after annealing or a machining operation. A number of experiments were carried out at the Author's foundry on a particular set of 12 castings that were cast every day in green-sand moulds. A core that had not been properly oxidized in the baking process was inserted in one mould per day. The result of this test showed that this particular type of core resulted in porosity in its locality on some occasions. Other sections in the same casting were free of pinholing, also the balance of the castings in the same cast of metal showed no signs of porosity.

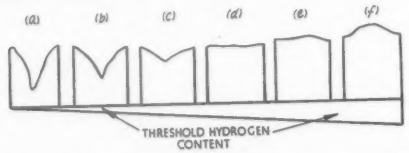
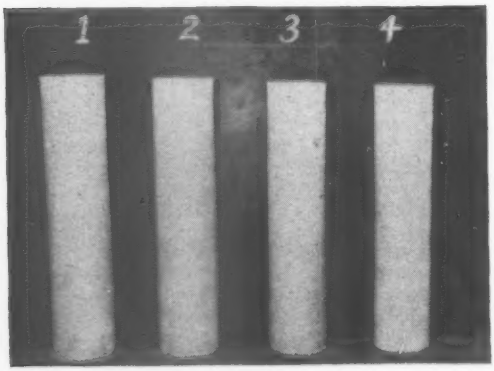


FIG. 31.—*Riser shrinkage properties in relationship to "threshold" hydrogen content of metal.*

Regularly, however, the test casting was entirely free from porosity in spite of that poorly-oxidized, inferior core which apparently then had no effect on the metal. The conclusions arrived at were that the mould and cores with conditions liable to promote porosity and which failed to do so, were cast with metal in (*a*) category which has already been referred to as a metal that will stand up to severe mould-reaction and remain free from porosity. This is the metal that foundrymen refer to as "good-feeding" steel. The sample casting that showed local porosity with the inferior core reaction would possibly be cast with metal of a type between (*b*) and (*c*) of the groups referred to earlier. If all the cores that were placed in the sample casting had been inferior, the casting would have been porous throughout. If these cores had been placed in several moulds, the result would have been the same.

FIG. 32.—*Irregularity in length of fireclay sleeves, as supplied.*



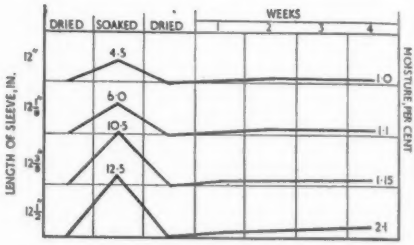


FIG. 33.—*Moisture pick-up of fireclay sleeves stored outside, with overhead protection only.*

With metal between types (*b*) and (*c*), the experiment described illustrates how on occasions a portion of a "heat" can result in pinholing in the castings, by reason of porosity-tendency conditions existing in some of the moulds, also care may have to be exercised to minimize turbulence with this type of metal The point arises as to how metallurgy of steelmaking can be made so good that the castings will not be so susceptible to faulty sand conditions, in so far as to create porosity. Good sand-practice, however, can help to offset the effects of metal supplied with a high "threshold" hydrogen content, particularly when metal is between (*b*) and (*c*) grades. Metal below category (*b*) cannot be helped in any way regarding porosity, even with the best sand practice.

Fireclay Runner Sleeves

Fireclay sleeves are made in various shapes and sizes to facilitate various methods of gating, and have been accepted as a good medium for introducing clean metal into a mould. Table I shows the reduction in size with firing temperature of a 12-in. sleeve. Over-firing tends to drop the spalling resistance, while sleeves that are under-fired are weak and friable, also they do not contract to their specific size, resulting in their having a higher degree of porosity. The lower section of Table I shows the result of three sleeves, one slightly over-fired while the other two are under-fired. Their

TABLE I.—*Contraction/Temperature Relationship for a 12-in. Fireclay Sleeve (Length: as-made, 13 in., and dry ("green") 12.63 in.)*

Firing temperature, deg. C.	Length, in.	Contraction, per cent.
900	12.58	0.4
950	12.52	0.9
1,000	12.42	1.7
1,025	12.34	2.3
1,050	12.25	3.0
1,075	12.13	4.0
1,100	12.00	5.1

Other Examples:

Over-fired, 8-in. sleeve: Actual length 7.91 in., approx. firing temperature 1,150 deg. C.

Under-fired 8-in. sleeve: Actual length 8.38 in.; approx. firing temperature, 1,000 to 1,025 deg. C.

Under-fired 12-in. sleeve: Actual length 12.365 in.; approx. firing temperature 1,000 to 1,025 deg. C.

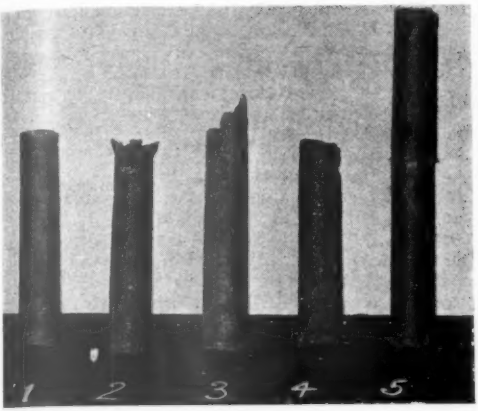


FIG. 34.—*Influence of moisture content of sleeves on runners cast through them.*

approximate firing temperature and also their resultant apparent porosity are given. High quality sleeves are consistent in size and lower in porosity, thereby being more resistant to moisture pick-up.

Fig. 32 shows four sleeves that were supplied in a batch nominally 12-in. long; the variation in length is obvious. Their inconsistency in length denotes irregular firing temperature (due possibly to their position in the kiln) which also coincides with a varied porosity. Fig. 33 illustrates the ability of the sleeves to absorb moisture in relationship to their length/porosity ratio when soaked. The examples shown were re-dried and placed outdoors with overhead protection only and four weekly tests were undertaken to determine the rate of moisture pick-up under these conditions. It is beneficial to keep sleeves stored in a dry atmosphere to avoid incurring detrimental results when used. When moulds which incorporate sleeves are stove dried, there is apparently little or no drying-out of the sleeves.

Fig. 34 shows a range of downgates, for which fireclay sleeves were used. The percentage moisture content of the various sleeves previous to ramming-up and stove-drying the moulds were:—No. 1, nil; No. 2, 1.8; No. 3, 3.2; No. 4, 5.2; and No. 5—two sleeves were used, the top one contained 4 per cent. moisture while the lower had none. The effects of increased moisture can be linked with the blowholes on the downgate which must also be associated with steam, that may intermingle with the incoming metal during the casting process and could be a detrimental factor, by stimulating the "threshold" hydrogen of the metal, thereby encouraging porosity.

Conclusion

An endeavour has been made to give a review of shop-floor practice and experiments in the steel foundry. Some experiments just satisfied mere curiosity, while others often indicated a better way. Several of the practices are unorthodox, but are beneficial to the particular type of castings where applied. An effort to present a variety of examples and the general principles of the methods employed has been the aim of this Paper, but many more avenues need exploration. Industry in general is becoming quality conscious, with present-day designers exploiting castings to the limit. Foundry practice being so full of variables, control is an essential factor, if the elimination of defective castings has to be pursued. This is not a matter for any individual, but the close co-operation of everyone concerned is necessary. Future demands may be more far-reaching than those of the present day. Rigid supervision of steel castings manufacture is required, to ensure uniformity and eliminate as far as possible the elements of uncertainty. If progress is to be made and successful results accrue, uncertainty and doubt should be "cast" outside the foundry, not inside it.

The Author wishes to thank the directors of the National Steel Foundry (1914), Limited, for permission to present this Paper and also members of the staff for their valuable assistance.

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Importance of Technical Education

An appeal to the Ministry of Education, industrial organizations, and local authorities for a better appreciation of the work of technical colleges was made at Birmingham recently by Mr. T. E. Hall (Liverpool), president of the Association of Teachers in Technical Institutions. He told the annual conference of the association that a lot of money needed to be spent on technical education at top level. "When I see reports of the Anglo-American Productivity Council and the report of the committee who visited the Latin-American countries, when I see what is being done on the Continent in the field of technical education, I am disturbed that this country is not in the forefront."

The industrial life of the nation was at stake, Mr. Hall declared. We were now in keen competition with other nations. We should harness the trade unions and the federations of employers, and make them realize the importance to industry and the employees of greater facilities for technical education.

FOLLOWING THE ACQUISITION by Edgar Allen & Company, Limited, steelmakers, etc., of Sheffield, of the business carried on by J. H. Humphreys & Sons, makers of electro-magnetic chucks, etc., of Oldham, a new company has been formed under the name of J. H. Humphreys & Sons, Limited, with an authorized capital of £100,000. From the original firm, the Blackriding Electrical Works, Werneth, Oldham, has been acquired, from which the business will be carried on without interruption.

International Metallurgical Conferences

American, German, French, and Belgian Societies meet in London

Members of overseas technical societies were received in London recently at the start of one of the most ambitious conferences arranged for metallurgists. This followed the acceptance by the American Institute of Mining and Metallurgical Engineers and the American Society for Metals of invitations from the Iron and Steel Institute, Institute of Metals and from the leading metallurgical societies in Belgium, France, Germany and Sweden to send representatives to this joint meeting in Europe. The objects of the meeting are to establish personal contacts between experts in the USA and Canada and in Europe, to provide opportunities for scientific and technical discussion, to enable visitors from the USA and Canada to see something of the metallurgical industries of Europe and to foster better understanding and co-operation among all concerned.

The London technical sessions took place on June 2 and 3, and works visits were arranged to follow in various parts of the country. However, the rail strike made many of the tours difficult, and some works visits were altered or cancelled. The participants moved to Düsseldorf on June 8 for further technical discussions and visits, and thence to Liège, Paris and other centres.

Technical Sessions

Subjects discussed in London on June 2, with the group leaders in each session, were as follow:—(*a*) Blast-furnace practice, G. D. Elliot, Appleby-Frodingham Steel Company; (*b*) steelmaking—basic O.H. furnace design and operation, Dr. T. P. Colclough, British Iron and Steel Federation; (*c*) melting and casting of non-ferrous metals, Dr. W. O. Alexander, ICI Metals Division; (*d*) continuous casting, W. A. Baker, BNFMRA and J. Savage, BISRA; (*e*) high temperature alloys, Dr. L. B. Pfeil, Mond Nickel Company, Limited; (*f*) education and training, W. D. Pugh, English Steel Corporation, Limited; (*g*) iron and steel making—desulphurizing and desiliconizing, Mr. H. A. Hacking, Richard Thomas & Baldwins, Limited; (*h*) steelmaking—the rôle of the electric arc-furnace, G. Tinker, Birlec, Limited; (*i*) production of steel strip and sheet, H. Edwards, John Summers & Sons, Limited (*j*) problems of high-speed wire drawing, R. S. Brown, Rylands Bros., Limited; (*k*) rate processes in metallurgy, Dr. D. McLean, NPL; (*kk*) heat-treatment of special alloys.

On Friday, June 3, the morning was devoted to further technical discussions, with visits in the afternoon to various metallurgical research laboratories. Discussions included: (*l*) Physical chemistry of steelmaking, Dr. J. Pearson, BISRA; (*m*) production of steel ingots of high quality, N. H. Bacon, Steel, Peech & Tozer; (*n*) production of metals of high purity, Dr. J. C. Chaston, Johnson, Matthey & Company, Limited; (*o*) extrusion, Dr. J. W. Jenkin, Tube Investments, Limited; (*p*) fracture of metals, Dr. N. P. Allen, NPL; (*pp*) heat-treatment of forgings, Dr. H. H. Burton, English Steel Corporation, Limited.

Over 180 delegates came from the USA, with about 150 from the Continent, and British participants registering totalled near 300. At a banquet on June 2, over 550 guests of the British Iron and Steel Federation heard speeches from Mr. A. G. Stewart, president of the Federation; the Lord Mayor of London, Ald. Sir Seymour Howard; Sir Charles Bruce-Gardner, president of the Iron and Steel Institute; H.E. the American Ambassador, Winthrop W. Aldrich; Dr. Maurice Cook, president, Institute of Metals; Dr. Clyde E. Williams, past president of the American Institute of Mining and Metallurgical Engineers, and Dr. G. A. Roberts, president of the American Society for Metals.

In a meeting of such widely varying interests under the generic title of "metallurgy," it is difficult to give a description of the technical discussions and visits in other than quite general terms.

Properties of Low-carbon Martensites

The purpose of a study of the mechanical properties of low-carbon martensites carried out by C. C. Busby, M. F. Hawkes, and H. W. Paxton and reported in a paper entitled "Tensile and Impact Properties of Low-carbon Martensites" submitted recently to the American Society for Metals, was primarily to obtain new basic information about such martensites, and to utilize this information in the development of high-strength steels having better ductility and toughness at each of several tensile strength levels. In this connection the mechanical properties of 38 low-carbon martensites (0.11 to 0.28 per cent. C) in the as-quenched and quenched and tempered condition were examined, and in all cases tempering was at 100 deg. C. It was found that the ductility as measured by reduction of area and elongation was greater at all tensile strengths from 80 to 116 tons/sq. in. than the average of higher carbon steels (0.3 to 0.5 per cent. C) quenched and tempered to comparable strengths. Brine quenching gave better properties than oil quenching.

Ignorance Wastes Fuel

Fuel is wasted because there are not enough men in British industry with the knowledge of how to use it properly. The lack of knowledge is evident at almost all levels, declares the National Industrial Fuel Efficiency Service in its first annual progress survey.

The most serious wastage is on the boilerhouse and furnace floors, the report says, because so much fuel can be wasted when the ill-trained man, or the man with no training at all, is firing a boiler by hand.

In the first year, the service has advised one in six of all consumers of over 100 tons a year.

A FORECAST of a considerable increase in the price of coal was made last week by Mr. D. P. Welman, chairman of the North-Western Gas Board. Speaking in London, Mr. Welman said he would not be surprised if the price of coal went up another 8s. a ton. He pointed out that for every shilling a ton increase in the price of coal his board had to find £110,000 a year.

Steelmaking Plant and Processes

Development Projects currently being investigated in the UK

Research and development projects at present under investigation in Britain to achieve and maintain optimum efficiency in the iron and steel industry cover many aspects of steel production—a number of them common to founding. A review of current research in this field is given, among other details, in the annual report for 1954 of the British Iron and Steel Research Association.

Operational Research

During the past year, the operational research section of the Steel Practice Committee has examined the flow of materials and the occurrence of bunching at a number of works. The reports of this study, which are to be published, provide a useful basis for improving the charging rate of the open-hearth furnace and minimizing the effect of bunching. However, given adequate charging facilities, there remains the task of melting down the charge and refining it rapidly. Efforts have been made to apply to production furnaces the results of flame-radiation research at Ijmuiden.

A two-image radiation pyrometer evolved by the division some time ago for the measurement of the temperature and emissivity of open-hearth furnace flames has been demonstrated as satisfactory, and was used by the United Steel Companies, Limited, in a series of experiments on the use of oxygen and during some flame-mechanism trials. Although the mechanism of heat-transfer in open-hearth furnaces is not fully understood, the measurements made on open-hearth flames, including those in the operating furnaces of the Royal Dutch Steelworks, have sufficed to show that the changes in radiating properties brought about by varying the flame in an open-hearth furnace are the same as those found in the experimental furnace.

It has been found that an increase in steam: oil ratio gives a flame of lower radiating power. Nevertheless such a change in steam: oil ratio is associated in open-hearth practice with an increase in melting rate. This anomaly, states the report, is being studied. It may be that the increase in steam: oil ratio results in a flame having a higher convective heat-transfer rate which more than compensates for its lower radiative power, and so increases the melting rate. Another possible explanation is that the lower emissivity of the flame allows the furnace to accept a higher total heat input rate for the same roof temperature. This indicates that the research on open-hearth flames, which so far has been concentrated on heat transfer by radiation, should now include work on convection. For this reason heat-flow meters for both radiative and convective heat transfer were developed.

At the Sheffield laboratories, a block heat-flow meter was evolved which measures the total of the convection and radiation heat-transfer rate from the flame. For luminous and non-luminous flames of similar velocity and thermal input, it was found that the total heat-transfer rates were approximately the same. This suggested that when radiative heat transfer is increased, for the same thermal input, it is at the expense of flame temperature.

Oil-burner Investigations

Work carried out by the fluid dynamics section of the Physics department has included a study of a model of an open-hearth furnace with two oil burners. This has shown that the two flames develop at first independently, and later join together and complete their combustion as a single flame. Slag-pocket design has also been studied, and results from models suggest that the efficiency of dust collection can be greatly increased by small modifications to existing designs. Model work on furnace downtakes has shown that air or steam jets directed vertically downwards from the top of the chill wall produce a more uniform distribution of gas flow which could reduce the erosion of the walls. It is hoped to test the method on a production furnace; the steam requirements would be about 5 per cent. of the steam normally used in an open-hearth oil burner.

The Guest Keen Iron and Steel Company, Limited has co-operated in tests of BISRA burner nozzles on a full-scale test-rig. The results confirmed those of earlier work on small burners at the Battersea laboratories, *i.e.*, that the nozzle is some 20 per cent. more efficient in producing jet momentum than are the nozzles now used by the industry.

Top-blown Oxygen Steelmaking

Small-scale trials of the top-blown oxygen steelmaking process on 3-ton lots of metal are being carried out intermittently by Edgar Allen and Company, Limited, with pig-irons supplied by other member firms. Early mechanical difficulties have been overcome, but a satisfactory operating technique for the production of high quality low-phosphorus has been converted to steel of 0.06 per cent. phosphorus content, during the production of which it was confirmed that phosphorus can be removed before the elimination of carbon. The object of these trials is to examine the top-blown oxygen process, both as a method of making steel from British irons and also as a method of pre-refining metal before charging into the open-hearth furnace or other finishing unit.

Co-operative experiments with the Cross Foundry Engineering Company, Limited, have shown that steel can be produced in small quantities by blowing oxygen into hematite iron in a ladle. The process, the report states, might be useful for iron foundries having occasional demands for steel which do not justify much additional capital expenditure. It is hoped to develop the process further.

Steelmaking Plant and Processes

Pyrometry and Gas Flow

Suction pyrometers for measuring temperatures of hot gases, states the Steelmaking Instruments Subcommittee, usually incorporate a refractory shield to reduce radiation between the measuring thermocouple and the surroundings. These refractory shields are rapidly destroyed by slag-laden gases present in open-hearth downtakes. It has been found that the life of the shield can be greatly prolonged by withdrawing it completely with a water-cooled sleeve. Suction pyrometers of this design have been used successfully in operating furnaces and have proved to be more accurate and consistent than conventional instruments. The greater accuracy arises from the fact that it is easier to shield the central thermocouple from the cooling effect of the jacket than it is to shield it from the heating effect of the walls of a furnace uptake.

Experience, gained in the determinations of gas-flow rates at various positions in open-hearth furnaces at different works by means of the radioactive tracer method developed a year ago, has shown that further simplifications of the method will be necessary before it can be used extensively. In some furnaces, the flow of gas in flues or uptakes is probably subject to persistent stratification, and the measurements made by the technique were not sufficiently reproducible to enable reliable conclusions about air infiltration to be reached. A radon-air mixture pulse technique is now being developed.

The BISRA water-cooled periscope has been used successfully in different furnaces by inserting it through the furnace door, back-walls and end-walls. Ciné films taken from each of these positions have given good views of the furnace interior, and a member firm is now using the instrument to investigate flame conditions. A modified periscope which will scan the whole roof very rapidly in a series of continuous sweeps and which could be readily adapted for roof temperature measurement is being developed.

Electrode Wear and Consumption

The work carried out for the Electric Process Subcommittee on the experimental arc-furnace has been concerned mainly with the relationships between power input, electrode size and roof height on the one hand, and electricity consumption, electrode consumption, and roof wear on the other. Electricity consumption has been considered only for the period of melting down and superheating to 1,600 deg. C., since during refining only small variations in input are usual and the electricity consumed depends mainly on the duration of this stage and on the kind of steel being made. For the melting and superheating period, increases in power input up to 550 kw. reduced the amount of electricity consumed, but over 550 kw. the increased losses in the transformer and bus-bars more than outweighed the slightly smaller loss from the furnace itself. Although 550 kw. is a very high input for a 10-cwt. furnace, the results suggested that even greater efficiency would have been obtained if a larger transformer had been available. Roof wear was slightly greater at high power input than at low, but electrode consumption was unaffected.

Experiments using 4-in. and 7-in. dia. electrodes have been carried out. A furnace of the size used for the experiments would normally employ 4-in. electrodes, though allied with a smaller transformer. With 4-in. electrodes the current density was greater than is usual on production furnaces, even allowing for the increase in current density permissible as electrode size decreases. With the 4-in. electrode, power consumption, roof wear and electrode consumption were lower. The electrode consumption was approximately proportional to the surface area of electrode within the furnace, and this was confirmed when using the roof at two different heights. It is thus clear that only a small part of the electrode consumption takes place at the arcing point, and that most of it occurs by burning of the electrode surface within the furnace. Increase in roof height increased power consumption very slightly, and reduced roof wear by about half. As a result of these investigations, a member firm has reduced the size of the electrodes used on a 15-18-ton furnace from 14 in to 12 in. dia.; first results indicate that the electrode consumption has been reduced.

Mould Designed for Uni-directional Freezing

In an attempt to promote uni-directional freezing from the bottom, states the Forging Ingots Sub-Committee, an ingot 9 in. square and 33 in. long was cast into a cold mould made of high-temperature insulating material seated on a heavy copper-base plate, the surface of the steel being covered with vermiculite. The ingot was found to be deeply piped, but the bottom half was very sound and reasonably free from segregation, although traces of A-segregate were noticed down one side. Examination of the etched structure indicated that the effect of the heavy chill had not extended very far up the mould. This suggested that more marked uni-directional freezing from the bottom upwards might be obtained by extending the chill portion of the mould part of the way up the sides, and that the pipe might be lifted by grading the refractory portion from high-conductivity material at the bottom to low-conductivity material at the top.

A new mould was, therefore, made to give an ingot 9 in. square and 27 in. long, which was of a more normal shape. The bottom 16-in. portion was made of graphite, and the remainder of successive layers of magnesite brick, firebrick, and high-temperature insulating brick, respectively. The mould was seated on a heavy copper-base plate. Two ingots have been cast in it; for one cast the mould was used cold and a top covering of vermiculite was added; for the other, the top part of the mould was heated before teeming, and the top addition consisted of a 1-in. layer of exothermic material, followed by vermiculite grains. Preliminary examination of the ingots shows that in both cases the pipe has been lifted very considerably. The structure and segregation are being examined.

Census of Production for 1951

Coke Ovens and By-products

A report on the Census of Production for 1951, Vol. 2, Trade A "Coke Ovens and By-Products" issued recently by the Board of Trade, relates to larger establishments engaged wholly or mainly in the manufacture of metallurgical coke, crude coal tar, ammoniacal liquor and low-temperature carbonization products. Gas undertakings are excluded.

TABLE I.—*Coke Oven By-product Output.*

	1951.	1950.	1949.
	£000	£000	£000
Gross output (production)* ..	93,773	81,356	79,738
Cost of materials and fuel used† ..	73,314	65,897	64,942
Payment for work done on materials given out	35	16	3
Transport payments ‡	3,602	—	—
Net output	16,822	15,443	14,792
Wages and salaries of persons employed	8,040	7,224	7,143
	Number	Number	Number
Average number of persons employed	18,725	18,568	18,829
	£	£	£
Net output per person employed	898	832	786
	£000	£000	£000
Stocks at end of year—			
Products on hand for sale and work in progress	1,004	1,106	1,499
Materials and fuel	4,198	3,212	3,173
	Number	Number	Number
Number of establishments ..	85	86	88

* Gross output for 1951 includes payments to other firms and undertakings and to firms' own separate transport organisations for transport services. For other years payments for transport services outwards on finished goods sold are excluded.

† Amounts paid for delivery services are excluded for 1951 but included for other years.

‡ Payments to other firms and undertakings and to firms' own separate transport organisations. For 1951 they cover payments for transport of both goods sold and materials and fuel purchased. For other years payments cover only transport outwards of finished goods sold. The Report is published by HM Stationery Office; price 1s. 6d.

Coal and Scrap Price Increases

FOUNDRY COKE: The British Coking Industry Association reports that the Minister of Fuel and Power has authorized increases in foundry coke prices with effect from June 5, as follow:—*Producing district—Scotland:* 6d. per ton, plus the 7½ per cent. increase in railway rates on previous rates. *Durham:* 4d. per ton plus 7½ per cent. in railway rates on previous actual rates from the customary focal point (*i.e.*, Brancepeth ovens), Willington, Co. Durham. *South Wales:* 4d. per ton plus 7½ per cent. in railway rates on the previous rates. *Lancashire:* a flat rate of 7d. per ton on all road and rail business.

IRON AND STEEL SCRAP: The Iron and Steel Scrap (Amendment No. 2) Order, 1955, of the Minister of Supply (SI 1955, No. 799), authorizes increases ranging from 6d. to 3s. 3d. per ton. All the above increases take into account the 7½ per cent. increase in railway-freight rates, which took effect on June 5.

DEVOTED to the continuous production of all types of pit tubs and mine cars, a new fabricating and assembly shop covering more than 11,000 sq. ft. has been opened at the Sheepbridge works of Sheepbridge Equipment, Limited, Chesterfield.

G. & J. Weir Jubilee

Under the title "A Seed was Sown," G. & J. Weir, Limited, of Cathcart, Glasgow, has produced a brochure in celebration of its diamond jubilee. The seed sown, in the early 1870's, was the determination of Mr. James Weir, one of the founders of the company, to improve the efficiency of steam-raising plants. How effective was his fundamental work and his early guidance is demonstrated by the growth of the organization.

June 14, the date of the annual general meeting, is the 60th anniversary of the formation of G. & J. Weir, Limited, as a limited company. Over the years the firm has expanded into a group of six separate associated companies, with branch offices in marine and industrial centres at home, and agents in 36 countries. Some of these firms have been Weir representatives for more than 50 years.

The old-established firm of Drysdale & Company, Limited, whose pumps and other products, complementary to Weir's, are also of international reputation, was brought into the Weir group in 1920.

The Argus Foundry was built by Weir's, also in 1920, in the outskirts of Glasgow to use the latest mechanized methods in the production of castings.

In 1925/26, a part of the Weir organization was formed into a separate group to reduce the prevailing housing shortage by building permanent steel-clad houses all over the country. With the shortage of houses after the war, this valuable experience was again called on, and resulted in the formation of the Weir Housing Corporation at Coatbridge in 1946. Its output of permanent houses, built by modern engineering production methods, is now the largest individual contribution to the problem in Scotland.

Zwicky, Limited, of Slough, became part of the Weir group in 1930, with specialized equipment for pumping and filtering oil products.

The latest addition to the Weir group of companies is Weir Valves, Limited, formed in 1950, and with a modern factory on the east side of Glasgow.

The partnership of George and James Weir in the 1870's which laid the foundation of the firm, and sowed the seed that has grown into the present organization, also inaugurated a family direction of the business which continues to the present time.

Unity in Non-ferrous Scrap Metal Trades

The application for membership of the *Bureau International de la Récuperation* by the National Association of Non-Ferrous Scrap Metal Merchants of Great Britain has been successful. The application was accepted at the congress of the bureau at Lucerne, held under the presidency of Mr. Hugo Nijkerk, of Holland. The Waste Trade Federation and the National Federation of Scrap Iron, Steel and Metal Merchants sponsored the association's application. Now that the national association will be directly represented within the international bureau, the unity of all the principal organizations in the United Kingdom concerned with the scrap metal trades is assured for action both in internal and international affairs.

The Lucerne congress was attended by Mr. R. J. Coley, of R. J. Coley & Son (Hounslow), Limited, who is president of the National Association of Non-Ferrous Scrap Metal Merchants of Great Britain. After the admission of his association he became its official delegate to the general assembly.

Tax Commission's Final Report

Recommendations in the final report of the Royal Commission on Taxation include a flat rate of profits tax; assessment on a current year basis; expenses of a business and an individual to be redefined on a more equal basis; special treatment for companies trading overseas; rejection of a capital gains tax; and an option to adopt the LIFO (last in, first out) method of stock valuation. The report, which was published on June 7, contains almost 500 pages.

A minority report of the commission calls for the introduction of a capital gains tax and proposes separate taxation for companies by a corporation profits tax. The commission, which was established by the Labour Government in 1951 to inquire into the system of taxation of profits and income with particular reference to taxation of business profits and salaries and wages and to recommend any changes thought necessary, while maintaining the same yield of income, has already issued interim reports in February, 1953, and April, 1954.

Nationalized Undertakings

The report finds that in principle nationalized undertakings should be taxed on the same basis as other concerns, and profits and distributions of public-utility undertakings should be taxed like those of other trading entities. Dealing with the definition of "income," the commission suggests a broadening to include profits realized by a business on the sale of capital assets, distributions by a company out of present exempt profits, the issue of bonus debentures, and certain casual transactions. Such profits would become taxable.

The commission proposes that the scope of the special legislation dating from 1948, which regulates tax treatment of benefits in kind and payments to reimburse expenses when received by a company director or an employee earning over £2,000, should be modified to exclude a director earning less than £2,000 unless a controlling director of a director-controlled company. It is recommended that directors or employees of charitable bodies or non-trading concerns should cease to be excluded, and that payments made as compensation for loss of office should be taxed.

A compromise suggestion is advanced in the report for recognizing a special category of overseas trading concerns to be styled "oversea trade corporations," the profits of which would be exempt from tax as long as undistributed.

A recommendation made by the commission affecting mining concerns is that a depletion should be granted for the cost of acquiring, after an appointed day, mineral rights or areas in the UK, while the report also advocates that capital allowances should be given for commercial buildings. The commission sees no sufficient reason for treating "bonus shares" as taxable income, as a capitalization of company reserves does nothing to increase the equity holder's real wealth in a company. Regarding benefits and expenses, the report says in addition that a director should be entitled to the same exemption as an employee in respect of living accommodation provided on business premises. The Inland Revenue is advised to abandon its attempts to take account of "home savings" when a director is away from home.

ENFIELD CABLES, LIMITED, announces that the South of Scotland Electricity Board has awarded the company a contract valued at approximately £130,000 for the supply and installation of cables between Dalmarnock 132-kV grid sub-station and Charlotte Street sub-station, Glasgow.

Ironfounders' First Quarter Output Record

For the first time on record, United Kingdom iron foundries have produced more than 1,000,000 tons of iron castings in a quarter. The actual output for the first quarter of this year was 1,018,000 tons. This is 2 per cent. above the previous peak, which was in the first quarter of 1952, and nearly 5½ per cent. above the first quarter of last year. The Council of Ironfoundry Associations stated on May 31 that the expansion in output is most outstanding for automobile castings. Production of these castings has increased by more than a quarter in the past year, and nearly one seventh of all iron castings by weight are now produced for the motor industry.

There is also a rising trend in the output of iron castings for the engineering industry generally. Production is fairly steady or shows small rises compared with a year ago for pipes, ingot moulds, and castings for building and domestic purposes. The only substantial fall has been in railway castings, where output dropped by 12 per cent. compared with the first quarter of 1954.

Of the 22 ironfounding districts in the United Kingdom, 15 had a higher output in the first quarter of 1955 than in the corresponding quarter of 1954. However, nearly half the extra output was produced in the west Midlands counties. Most of the other major producing districts have changed their output relatively little. There were small increases for Derbyshire and Nottinghamshire, Westmorland and Lancashire, and the East and West Ridings of Yorkshire, and small decreases for Scotland, and Northumberland, Durham, and Middlesbrough. Some of the smaller producing districts showed good increases.

Stocks of pig-iron at iron foundries were well maintained during the first quarter of 1955, with the exception of hematite, stocks of which fell following the development of a considerable stringency in supplies. It is expected that this particular stringency will be only temporary, but the expansion in ironfoundry output is causing a fairly general tightening in the supply position of most grades of pig-iron and scrap.

AEI Offer to Siemens Bros

Holders of the £550,000 10 per cent. cumulative preference stock of Siemens Bros. & Company, Limited, electrical engineers, etc., of London, S.W.1, are to receive an offer from Associated Electrical Industries, Limited, of two AEI 4½ per cent. "B" cumulative preference shares of £1 each and a cash payment of 5s. for every unit held.

Those accepting the offer will receive the half-year's dividend payable on July 15, 1955, and the preference shares in AEI to be allotted in exchange will be entitled to the full half-year's dividend payable on January 1, 1956. The offer is subject to the approval of a meeting of AEI to authorize the necessary increase in capital, and to such class meetings of preference and ordinary stockholders as may be necessary.

Shareholders of Associated Electrical Industries accepted over 98 per cent. of the recent one-for-four rights issue of ordinary £1 shares at £2 each. Shares available for employees totalled 312,340, comprising the original 215,485, 6,068 arising from fractions, and 90,787 not taken up by shareholders. These shares were applied for by 7,385 employees, who receive full allotment for applications up to 58 shares and an allotment of 58 shares for applications above that figure.

News in Brief

HIGGS MOTORS, LIMITED, announce that their offices and works will be closed for the annual holiday from the evening of Friday, July 22, until Monday morning, August 8.

THE ALUMINIUM DEVELOPMENT ASSOCIATION, 33, Grosvenor Street, London, W.1, has just issued a new directory of members. It is an extremely useful book as it includes an Index of Products section.

SINCE JUNE 15, Winston Electronics, Limited, of Hampton Hill, Middlesex, manufacturers of specialized electronic equipment, have been at their new factory premises at Grovett Avenue, Shepperton, Middlesex.

TEN MEMBERS of the Scientific Instrument Manufacturers' Association of Great Britain are to exhibit at the First International Exhibition of Peaceful Use of Atomic Energy to be held in Geneva from August 8 to 21.

RHODEN PARTNERS, LIMITED, who specialize in the design and development of plant and machinery, will remove from 6, Ganton Street, London, W.1, to larger premises at 51, North Row, London, W.1 (tel.: MAYfair 6248), on June 18.

A DAY'S EXCURSION to Bridlington, on June 8, was organized by the English Steel Corporation, Limited, Sheffield, in conjunction with the sports club, for 558 retired employees. The party included a number of disabled people and hospital patients.

AS PART of a campaign to keep one of Staffordshire's best-known beauty-spots tidy, "Friends of Cannock Chase," a voluntary organization devoted to preserve the amenities of the area, devoted the week-end of June 4 to 5 to collecting scrap iron from the area. Two lorry-loads of metal were collected and removed.

A CONTRACT valued at £450,000 has been secured by Sir William Arrol & Company, Limited, Glasgow, for the construction of a new highway suspension-bridge over the Euphrates, about 175 miles south of Baghdad. The order from the Iraq Development Board, includes approach roads which will lead to a main 26-ft. carriageway across the bridge.

FIRTH BROWN TOOLS LIMITED, Speedicut Works, Carlisle Street East, Sheffield, made deliveries of engineering tools by helicopter on June 3, to Manchester, Birmingham and London. The firm resolved that despite the railway strike deliveries should be on time and chartered a Westland S 51 machine from Westland Aircraft Limited, of Yeovil.

MR. JOHN AND MR. SAMUEL HALL, brothers, were among the employees presented with medals and cheques by Cameron & Roberton, ironfounders, Kirkintilloch, on June 3, for more than 50 years' services with the firm. Three of the 12 qualified have died since the completion of their half-century of service, and medals were presented to their widows.

A RESOLUTION calling for action to increase the number of factory inspectors to carry out a greater drive towards prevention of accidents was passed at the conference of the Amalgamated Society of Woodworkers at Blackpool. The conference suggested that penalties for violation of the Factories Act should be increased and that employers should be liable to imprisonment for persistent offences.

THE stand of British Insulated Callender's Cables, Limited, at the British Electrical Power Convention Exhibition, Brighton, June 27 to July 1, will reflect the wide ranging interests of the company in the field of electrical transmission. Overhead transmission items will include steel-cored aluminium conductors for use up to 275 kv. and the more recently introduced self-supporting VRI high-voltage aerial cables.

TO MARK THE OCCASION of the celebration of the 21st anniversary of its establishment as a company, Magnesium Elektron, Limited, has invited representatives of all its licensees in Great Britain and overseas to visit the works at Clifton Junction, Manchester, on June 16 and 17. Short papers will be read, and discussed, covering the more recent developments, and an exhibition of magnesium products made in Britain will be assembled.

AN INVESTMENT CASTINGS PLANT has recently been established by West Products (Metals), Limited, at 161, High Street, Hampton Hill, Middlesex. The company is operating under mutual agreement with an American concern and is introducing several US techniques in its processes. In addition to the normal range of steel alloys, they are also undertaking to make investment castings of components in copper-base, aluminium magnesium, and titanium alloys.

FIFTY-SIX METALLURGISTS from America, France, Italy, Germany and Japan met in Sheffield over the week-end beginning June 3. They were in this country under the auspices of the Iron and Steel Institute and the Institute of Metals. Places visited included Thos. Firth & John Brown Limited, BISRA Laboratories, English Steel Corporation Limited, the Swinden Laboratories of United Steel Companies Limited, Hadfields Limited, and William Jessop & Sons Limited.

THE ASSOCIATION of Sheffield industry with its university was emphasized in an address presented by Mr. W. G. Ibberson, Master Cutler, to Lord Halifax, Chancellor of the University, in the Cutlers' Hall, on the University's Charter Day. The address stated, "We recall with profound appreciation the work of Sheffield University in wide fields of research which has been the means of providing outstanding benefits to mankind as well as to the industries of the city."

MAGNETIC EQUIPMENT COMPANY, LIMITED, are now represented in Holland by Berg & Burg, De Ruyterkade 141-142, Amsterdam; in Belgium by Willy Depireux, Rue Hector Denis 74, Mont-Sur-Marghienne, Charleroi; in the Republic of Ireland by Modern Plant & Appliance Company, 64, Aungier Street, Dublin. The Company has been meeting with considerable success on the Continent and recently secured an order for ten 100-ton feeders for John Cockerill's steelworks at Liége.

THE EXECUTIVE of the Scottish Council (Development and Industry), meeting in Edinburgh, appointed a committee to maintain the good work done by the 1954 Scottish Industries Exhibition in Glasgow and "to promote exports from Scotland generally." Dr. Christopher Macrae, secretary of the Council, stated that it was the policy not to hold annual exhibitions, but to space them at reasonable intervals so that when held the exhibitions would be a real attraction to potential customers.

THE BIRMINGHAM AND DISTRICT INDUSTRIAL SAFETY GROUP is staging an exhibition and congress at Bingley Hall, Birmingham, from June 24 to July 1. In this connection the Council of Ironfoundry Associations is organizing a half-day conference. The speakers will include Mr. Colin Gresty; Mr. H. A. Bonney; Mr. Kenneth Marshall, and Mr. W. H. White. Tickets for the conference (5s., to include tea) are available from Mr. W. G. Appleyard, Museum of Science and Industry, Newhall Street, Birmingham, 3.

News in Brief

FOLLOWING A REQUEST made to them by the British Iron and Steel Research Association, two Scots metallurgists—Dr. J. Cameron, Motherwell, and Mr. Harry E. Crivan, Glasgow—are to contribute sections to a book entitled "The Casting of Steel." Dr. Cameron is chief metallurgist at the Clyde Alloy Steel Company, Limited, Motherwell, and Mr. Crivan is head of the Department of Metallurgy at Coatbridge Technical College. The book, which is to be published in the autumn, is being written not only for metallurgists, but also for foundry craftsmen and engineers.

AT the British Instrument Industries' Exhibition at Earls Court, June 28 to July 9, the stand of Hanovia (Lamps Division of Engelhard Industries, Limited), (No. 17, Block B), will display a wide range of ultra-violet ray equipment for use in industry, including "Chromatolite," a fluorescent lamp in which short waved ultra-violet rays at 2537 A.U., are applied to the examination of chromatograms and to fluorescence investigations in general, and a range of portable and laboratory fluorescence lamps for use in crack detection in metals.

THE PROBLEM of producing metallurgical coke from coal other than typically coking coals is one which in various degrees affects most of the pig-iron producing countries. It is being approached in Western Germany by producing a material called ferro-coke. The subject is referred to in a publication entitled "Recent Advances in Steel Technology and Market Development, 1954," prepared by the Industrial Division, Economic Commission for Europe and published by the European Office of the United Nations, Geneva. (Price, 3s. 9d.)

UNITED STEEL COMPANIES LIMITED brought their new airfield at Norton, Sheffield, into use for the first time on June 1, when Mr. T. S. Kilpatrick, commercial manager of the Workington Iron & Steel Company, and the Distington Engineering Company, Limited, touched down on his way from London to Workington. The pilot was Mr. Ronald Leathers, a foreman in the Workington rolling mills. The company's plane is an Auster V and they secured the airstrip recently for use of executives travelling between the firms and different centres.

ABOUT 60 MEMBERS and guests of the Non-Ferrous Club were present at the luncheon held on June 6, at the Queen's Hotel, Birmingham. The principal guest was Mr. J. G. Newland, of Midland Silicones, Limited, who gave a short exposition of the properties, applications, and some of the limitations of silicones, in both the industrial and domestic fields. Gifts to charitable organizations are one of the purposes of the club, and a round-the-table collection resulted in a cheque for £12 being presented to the Royal Society for the Prevention of Cruelty to Children.

OF THE 30 replies received by the Royal Meteorological Society in response to its recent appeal for information about the weather of the past (for systematic official recording is of comparatively recent date) one has revealed that there is much data about contemporary weather conditions in the papers written by Matthew Boulton and James Watt of the Soho Foundry between 1793 and 1830. These two famous foundrymen thus take on the new rôle of being early meteorologists, now held in esteem by the official modern Society, for their prudent recording.

DOVER ENGINEERING WORKS LIMITED, have approached the Dover Borough Council with a view to purchasing land on the Chitty's Mill side of Bridge Street for the further extension of their foundry and works. Some years ago, the company purchased Chitty's Mill and built new offices on a part of the site. The Dover Planning Committee have recommended the Council to open negotiations with the company, expressing the opinion that they should be assisted in their plans for further expansion. The Council are to inform the present leaseholders of the land of their intentions. The leases expire in December, 1957.

A RAPID INEXPENSIVE nickel/phosphorus coating is claimed by G. J. Harvey, assistant technical director, New York Testing Laboratories, Inc., writing in "Iron Age" recently, to give mild steel, corrosion-resistant properties comparable to certain stainless steels. Any thickness of a high-nickel low-phosphorus alloy, it is said, can be coated on vessels and piping of all shapes and sizes. In the process, an oxide of nickel is reduced on the surface to be coated, and at a much lower temperature than the melting point of either the base metal or elemental nickel. "Niphos" process, as it is called, is claimed to be rapid and relatively simple to apply, requiring little skill.

A NEW BLAST FURNACE of British design, French construction, was recently put into operation at the iron and steelworks of Sidelor d'Homecourt in France in the presence of Mr. Lethiais, *sous-prefet* de Briey, Mr. Carbonneil, Mayor of Homecourt, Mr. Baboin, vice-president of the board of directors, and Mr. Touze, director-general. Before being lit by Mme. Baboin, it was baptized in accordance with the traditional "Liturgie" dating from 1704. The furnace is one of the most modern on the continent and, with a hearth diameter of approximately 22 ft., will consume 500 tons of coke per day. When using only the low-grade Lorraine ores, 450 tons of iron per day will be produced, but the daily output will be substantially greater than this because of scrap and other additions to the burden.

CONTRACTS to the value of £4,300,000 have been placed with two Scottish firms by the North of Scotland Hydro-Electric Board in connection with the Orrin hydro-electric scheme in Ross-shire. Duncan Logan (Contractors), Limited, Muir of Ord, Ross-shire, will build a dam at Orrin—150 ft. high and 1,000 ft. long—five miles up-stream from the Orrin Falls. Whatlings, Limited, Glasgow, have been given the contract for the 16,000 ft. tunnel which will carry water from the new reservoir formed by Orrin Dam to a new power station in Strathconon near Achnokie on the southern shore of the small lake created by Tor Achilty Dam. This power station will have a total capacity of 16,000 kw. The Orrin scheme, which is the third stage of the Conon Valley developments, will harness the water-power resources of an area extending to 54 sq. miles and draining into the river Orrin.

A SPECIAL MEETING and visit to Western Germany was held by the Refractories Association of Great Britain late last month, the hosts being Fachverband Feuerfeste Industrie e.V. The president, Mr. Norris Clark (Astbury Silica Company, Limited), led the British contingent, and was accompanied by a number of past-presidents. On May 18, a joint technical session was held at the headquarters of *Verein Deutscher Eisenhüttenleute*, when the following four papers were given and discussed:—"Refractories in Great Britain—a Survey of Recent Trends," by Dr. J. White (Sheffield University); "Refractories Research and its Application in Great Britain," by Dr. A. L. Roberts (Livesey Professor of Leeds University); "Trends in German Silica Bricks for Open-hearth Roofs," by Dr.-Ing. K. Konopicky; "Procedure when Sieving Wet Materials," by Dr.-Ing. W. Bathel (*Forschungsinstitut für Verfahrenstechnik*).

A grinder running at constant speed under load will remove more metal in a shorter time and with less wheel wear than any machine which slows up under the efforts of the operator. That is why iron and steel foundries and other works where Hicycle grinders are installed are getting more work done per operator than is possible with any other type of tool. Only Hicycle grinders have this constant speed characteristic, and there is a full range of models from small die grinders to 8in. heavy duty machines. Ask for a descriptive brochure on Hicycle grinders and other Hicycle production tools.

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Consolidated Pneumatic

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THE CONSOLIDATED PNEUMATIC TOOL COMPANY LTD., 232 DAWES ROAD, LONDON S.W.6

Personal

Mr. P. E. W. GRENSTED has been elected to a fellowship for research in engineering at Christ's College, Cambridge.

Mr. NORMAN C. MACNAB has been appointed assistant sales representative of the Forth & Clyde & Sunnyside Iron Companies, Limited, Falkirk.

Mr. K. J. CLARKE has been appointed assistant manager of the Sheffield district office of the British Thomson-Houston Company, Limited.

Mr. GEORGE WAUGH, a director of the North-East Coast Coal Exporters' Association, has been appointed honorary German consul at Newcastle-upon-Tyne.

Mr. ROBERT L. GREEN has joined Winston Electronics, Limited, as a senior development engineer responsible for telecommunications research and development.

Mr. F. E. MCGINNETY has been appointed director of the Inspectorate of Electrical and Mechanical Equipment of the Ministry of Supply with effect from July 1.

COLLOIDAL GRAPHITE, LIMITED, announce that, following the recent extension of their plant, their technical manager, Mr. R. W. BURCHHARDT, has been appointed a director.

Mr. G. N. SMITH has been appointed president of the Keighley (Yorks) Association of Engineers and has therefore resigned from the office of treasurer, which he has held for five years.

Mr. THOMAS POWELL, managing director of British Electro Metallurgical Company, Limited, has been appointed to the board of British Acheson Electrodes Limited, in the capacity of deputy managing director.

Mr. R. C. BLOXHAM, manager of the commercial relations department of the overseas division of the Dunlop Rubber Company, Limited, has been appointed export sales manager of Dunlop Special Products, Limited.

Mr. A. BOYES has been appointed general manager of the East Sussex Engineering Company, Limited, of Lewes, Sussex. He was previously works manager of the Railway and General Engineering Company, Nottingham.

Dr. H. E. Z. GORDON, who until recently has been active as the UK representative of Battelle Memorial Institute, is now devoting himself to the interests of Battelle Development Company, Limited, of which he is general manager.

Mr. J. F. BODY, who succeeded Mr. S. C. Tyrrell as chief accountant of Newton, Chambers & Company, Limited, in 1954, has been appointed a local director of the company. Mr. Body joined Newton, Chambers in 1948 as assistant chief accountant.

REAR-ADMIRAL J. G. C. GIVEN has been appointed to the board of Parsons Marine Turbine Company, Limited. He will succeed Mr. Andrew Hopper as managing director when Mr. Hopper retires at the end of this year, after 54 years' service with the company.

Mr. A. D. FOWLER, who is 67, has retired after nearly 53 years with the Appleby-Frodingham Steel Company (branch of the United Steel Companies, Limited). When the new Appleby melting shop was opened in 1926 he became gas foreman.

Due to continued ill-health, Mr. WILLIAM D. MURRAY, has resigned his position as London manager of M. & C. Switchgear, Limited. His services are, however, retained in a consultative capacity. Mr. JAMES HODGE, the new London manager, has had 16 years' service with the company.

BONNINGTON CASTINGS, LIMITED, announce that Mr. Daniel Brown, their works manager, has been elected to the board of directors as from June 10. Mr. Brown is the retiring president of the Scottish branch of the Institute of British Foundrymen. He has been in the employ of the company and an associated company, the North British Steel Foundry Limited, Bathgate, for 20 years.

MEMBERS of the Royal Institution of Chartered Surveyors recently elected Mr. WILLIAM ROBINSON BRACKETT to be their new president in succession to Mr. C. P. Bowyer. Mr. Brackett is senior partner of Henry Hallam & Son, Nottingham, which specializes in valuation, rating, and compensation work. He holds the Special (Rating) Diploma of the institution, and is also a member of the Rating Surveyors' Association, of which he was president in 1953.

AMONG those who are to receive honorary degrees from Liverpool University at the beginning of next month is Sir CHRISTOPHER HINTON, F.R.S., on whom the degree of Doctor of Engineering will be conferred. In February it was announced that the Institution of Mechanical Engineers had awarded Sir Christopher the 1954 James Clayton prize for his pioneer work in applying the results of nuclear research to the production of fissile material and industrial power.

Obituary

Mr. A. J. DESMEDT, who died recently, was employed as a brass and bronze figure-moulder at the Frome foundry of J. W. Singer & Sons, Limited, for over fifty years.

THE DEATH is announced of Mr. P. J. JEMMETT at the age of 76. He was chairman and managing director, since its incorporation in 1919, of Manley & Regulus, Showell Works, Wolverhampton.

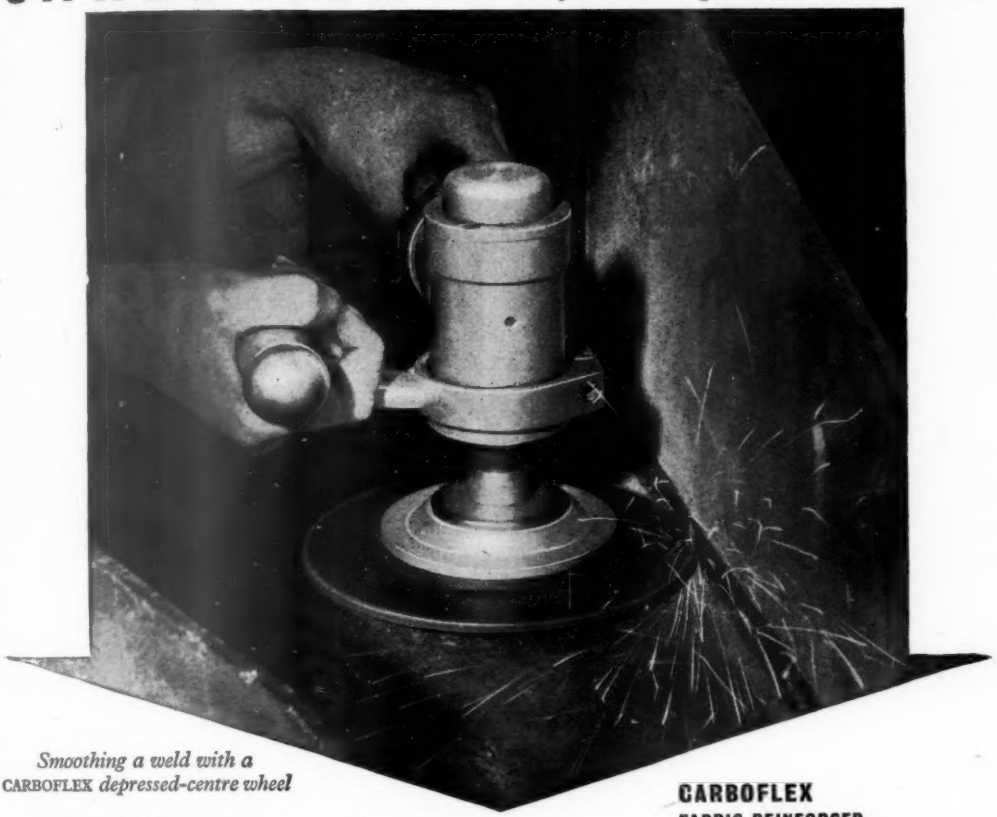
Mr. P. G. HOPCROFT, Midland sales representative of Richard Thomas & Baldwins, Limited, died on June 5 at the age of 66. He joined the company in 1902 and thus had 53 years' service with the firm. Mr. Hopcroft was a Justice of the Peace and a former chairman of Stourport Council.

Mr. MICHAEL JOHN LYONS, only son of Mr. William Lyons, chairman and managing director of the Jaguar Company, was killed near Cherbourg on June 6, in a car he was taking to Le Mans for the 24-hour race during the week end of June 11 to 12. Mr. Lyons was 25. He was not competing in the race himself but was delivering one of the Jaguar cars, to be used by a foreign entrant.

Mr. ANDREW MACFARLANE MACKECHNIE, chairman and managing director of William Hume & Company, Limited, brassfounders, Port Glasgow, has died at Craigmore, Rothesay, at the age of 57. He succeeded to the control of the business on the death of his father. He was one of the best-known authorities on the history of the Clyde steamers and was one of the founders and president of the Clyde River Steamer Club at Glasgow.

Mr. CHARLES LIDIARD JENNER, motor-engine-project designer for Rolls-Royce, Limited, Derby, has died, aged 62. Mr. Jenner served his apprenticeship with the Phoenix Motor Company, later he joined Rolls-Royce, and from 1918 was with Sir Henry Royce at Wittering, working directly under Mr. A. G. Elliot, the present executive vice-chairman of the firm. Later, he returned to Derby, and was engaged on motor and diesel-engine design at Belper from 1945-1951.

CARBOFLEX *Fabric-reinforced, depressed-centre wheels*



Smoothing a weld with a CARBOFLEX *depressed-centre wheel*

A BRILLIANT NEW MULTI-PURPOSE TOOL

Weld-smoothing operations of all kinds are done better, more quickly, and more economically, by CARBOFLEX fabric-reinforced, depressed-centre wheels than by any other tool. The thousand and one other uses for these wheels include: de-scaling and de-burring, smoothing flame-cut edges, cutting sheet metal, grooving seams for welding, bevelling sheet metal, and cleaning up castings. Speeds up to 16,000 s.f.p.m. may safely be used. CARBOFLEX depressed-centre wheels are among the most versatile of all engineering tools. No foundry or welding shop should be without them.

CARBOFLEX
FABRIC-REINFORCED, DEPRESSED-CENTRE WHEELS FOR ROUGHING, SMOOTHING, GROOVING, OR CUTTING, CAST IRON, STEEL, PHOSPHOR BRONZE, MANGANESE BRONZE, ALUMINIUM, BRONZE, COPPER, MAGNESIUM BRONZE, GUNMETAL, MARBLE, AND MANY OTHER MATERIALS

THE MOST USEFUL ABRASIVE TOOL FOR FOUNDRY OR WELDING SHOP

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THE CARBORUNDUM CO. LTD. MANCHESTER

Raw Material Markets

Iron and Steel

The foundries have been doing their utmost to keep going and supply their customers with castings, but they have been encountering great difficulties. Before the rail strike stocks of pig-iron and coke, particularly the former, were at a very low ebb at both the furnaces and the foundries, so that the foundries, in order to keep going, have had to arrange for supplies by road. In many cases this has been possible, but some furnace plants are not laid out to give access to road vehicles. Road haulage adds considerably to costs; in some instances it has meant sending lorries from the English Midlands and even farther south as far as Scotland, but there has been determination on the part of the employers to keep men at work at almost any cost. Supplies of coke have similarly been made available, considerable quantities having been distributed all over the country by road.

Makers of pig-iron have been maintaining production so far as raw materials permit.

Re-rollers had very limited amounts of steel in stock at the outbreak of the strike and by far the larger portion of their supplies is customarily handled by rail. Only limited tonnages have been delivered by road transport. Makers of billets have been obliged to curtail outputs.

Although a lot of finished steel has been collected by road, only a small percentage being accepted by the railways, reduction of output has been forced on the steelworks. The loss will be a serious setback to all consumers. Supplies of structural steel and stamping steel were being purchased from the Continent before the stoppage and it will be more necessary than ever for consumers to consider the purchase of supplies outside the country.

Non-ferrous Metals

No announcement has been made by the Rhodesian Selection Trust, which is maintaining a special copper price of £280, at the end of the first 30 days of the scheme. This figure persists, but is now subject to 24 hours' notice of change. Copper in London dropped back at the end of the week and on balance closed £6 down for cash and £4 lower for three months, the backwardation being £15. On the whole, the non-ferrous industry seems to have coped remarkably well with the situation created by the railway strike and the stoppage at the docks, but in due course some effect will be felt.

British Bureau of Non-Ferrous Metal Statistics figures for April show a sharp drop in copper consumption, for the total, at 48,146 tons, was 9,649 tons lower than March and this decline can hardly be explained by the intervention of the Easter holiday. The reduction was more or less equally divided between scrap and refined metal. Stocks of virgin copper were also down, the total of 60,767 tons at April 30 comparing with 67,566 tons at March 31.

In zinc, there was an improvement in stocks to 53,573 tons, but consumption, all grades, dropped to 27,741 tons, a decline of 5,710 tons. Nevertheless, zinc has been quite a firm market of late and last week saw an advance of £1 10s. for prompt and of £1 15s. forward. US consumption in March rose to 95,988 short tons, which was a new record.

Lead was steady on the market and unchanged last week, apart from a drop of 5s. in first half June, but business with consumers was quiet. The bureau figures showed a decline of 4,569 tons in the April usage to 28,656 tons, but stocks rose from 37,587 tons to 45,226 tons. On the whole, the lead market in London remains remarkably firm. Tin was firm last week with a rise of £8 in cash and of £8 10s. in three months. Consumption dropped from 2,057 tons in March to 1,741 tons in April.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* June 9, £340 10s. to £341; June 10, £339 to £339 10s.; June 13, £339 to £340; June 14, £343 to £344.

Three Months: June 9, £324 to £324 10s.; June 10, £323 to £324; June 13, £325 to £326; June 14, £329 10s. to £330 10s.

TIN, Standard—*Cash*: June 9, £721 to £721 10s.; June 10, £725 10s. to £726 10s.; June 13, £728 10s. to £729; June 14, £728 to £728 10s.

Three Months: June 9, £721 10s. to £722; June 10, £726 10s. to £727; June 13, £728 10s. to £729; June 14, £727 10s. to £728 10s.

LEAD—*First half June:* June 9, £102 15s. to £103; June 10, £103 2s. 6d. to £103 5s.; June 13, £102 15s. to £103; June 14, £102 to £102 2s. 6d.

First half September: June 9, £102 15s. to £103; June 10, £103 2s. 6d. to £103 5s.; June 13, £102 15s. to £103; June 14, £102 7s. 6d. to £102 12s. 6d.

ZINC—*First half June:* June 9, £90 15s. to £91; June 10, £91 10s. to £91 15s.; June 13, £92 5s. to £92 10s.; June 14, £92 5s. to £92 10s.

First half September: June 9, £89 5s. to £89 10s.; June 10, £90 to £90 5s.; June 13, £90 10s. to £91; June 14, £90 10s. to £90 15s.

[*The official prices for yesterday (Wednesday) are given in the list of current prices on page* 36.]

Trade Union Education

Mr. Frank G. Woollard, who since his retirement from Birmid Industries, Limited, is an industrial consultant in Birmingham, was the chief speaker at a conference in Birmingham on June 5 organized by the Birmingham Group for Trade Union Education, a body which seeks to promote a more thoughtful approach to trade unionism among rank-and-file members. "Automation" was the theme of the conference and Mr. Woollard said that the automatic factory presented no threats of unemployment neither in the long term nor during its introduction. Industry, introducing more-efficient and labour-saving automatic devices, could not afford to have people unemployed. The workers needed to be prosperous to be able to buy the many new products that would pour from the automatic factories.

On the same day, and also in Birmingham, a joint meeting of 350 shop stewards from five of the largest firms in the UK motor industry (Ford, the British Motor Corporation, Rover, Standard and Rootes), with some representatives of motor accessory firms, was held, and again the subject for discussion was the industrial and social effects of the movement towards automatic factories. Among speakers who addressed this meeting were Dr. Samuel Lilley, of Birmingham University Extra-mural Department, who has made a special study of automation. He said that the trend should be welcome for the rising level of skill it will demand in the factory. The automatic transfer plant introduced at the Longbridge factory of the Austin Motor Company, Limited, he said, had reduced the labour costs of cylinder-block processing from £2 17s. 2d. an hour to 11s. The production cost of each block had been reduced from 2s. 4d. to 1s. 1½d.

FIRST WITH W20

Now **BEETLE RESIN* W42**

This new synthetic resin core-binder has been specially developed to suit those foundries where fumes and casting odours cause embarrassment. The result of practical co-operation between B.I.P. and leading foundries, Beetle W42 is another example of B.I.P.'s pioneer research and service to the Foundry Industry. W42 has been formulated with the Garrett Report in mind and it possesses all the advantages of Beetle Resin W20, coupled with this important new feature . . .

reduced casting odour

* *Patent Application 32896/58*

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London Office: 1 Argyll Street, W.1. *'Beetle' is a trade mark registered in Great Britain and in most countries of the world.*

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

June 15, 1955

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £15 12s. 0d.; Birmingham, £15 5s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £17 13s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £18 9s. 3d.

Scotch Iron.—No. 3 foundry, £18 2s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £20 4s. 0d.; South Zone, £20 6s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £21 1s. 6d.; South Zone, £21 4s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £18 2s. 6d.; Scotland (Scotch iron), £18 9s. 0d.; Sheffield, £19 7s. 6d.; Birmingham, £19 14s. 6d.; Wales (Welsh iron), £18 9s. 0d.

Basic Pig-iron.—£15 15s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots).—40/55 per cent., £40 15s. 0d., basis 45 per cent. Si, scale 15s. per unit; 70/84 per cent., £63 0s. 0d., basis 75 per cent. Si, scale 16s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 11s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £161 0s. 0d. to £165 0s. 0d. per ton; 38/40 per cent., £258 0s. 0d. to £262 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 16s. 9d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 19s. 9d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £83 0s. 0d. to £86 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £81 0s. 0d. to £84 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C,* 1s. 10½d. per lb. Cr; 1 per cent. C,* 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr; 0.10 per cent. C,* 1s. 11d. to 2s. 2d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per b. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. to 7s. 4d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £259 0s. 0d. to £265 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £53 17s. 6d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 5s. 0d.; tested, 0.08 to 0.25 per cent. C, £26 5s. 0d.; hard (0.41 to 0.60 per cent. C), £27 10s. 0d.; silico-manganese, £34 10s. 0d.; free-cutting, £29 6s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 17s. 0d.; silico-manganese, £34 10s. 0d.

* Average 68-70 per cent.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 15s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £33 11s. 6d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 19s. 6d.; flats, 5 in. wide and under, £31 19s. 6d.; hoop and strip, £33 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £34 5s. 0d.; black sheets (hand mill), 17/20 g., £43 13s. 6d.; galvanized corrugated sheets, 24 g., £55 4s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £54 7s. 9d.; nickel-chrome, £76 7s. 9d.; nickel-chrome-molybdenum, £86 8s. 6d.

NON-FERROUS METALS

Copper.—Cash, £344 0s. 0d. to £345 0s. 0d.; three months, £332 0s. 0d. to £332 10s. 0d.; settlement, £345 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 3s. 3½d. per lb.; rods, 381s. 0d. per cwt. basis; 20 s.w.g., 414s. 3d. per cwt.

Tin.—Cash, £727 0s. 0d. to £728 0s. 0d.; three months, £727 0s. 0d. to £727 10s. 0d.; settlement, £728 0s. 0d.

Lead (Refined Pig).—First half June, £102 5s. 0d. to £102 10s. 0d.; first half September, £102 10s. 0d. to £102 15s. 0d.

Zinc.—First half June, £91 10s. 0d. to £91 15s. 0d.; first half September, £90 0s. 0d. to £90 5s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £123 5s. 0d.; rolled zinc (boiler plates), all English destinations, £121 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £103 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 7½d. per lb.; rods, drawn, 3s. 4½d.; sheets to 10 w.g., 335s. 9d. per cwt.; wire, 3s. 2½d.; rolled metal, 321s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £212; B6 (85/15), —; BS249, £224.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £270; HTB2 (38 tons), £278; HTB3 (48 tons), £285.

Gunmetal.—RCH, 3/4 per cent. tin, —; BS1400, LG2 (85/5/5/5), £296; LG3 (86/7/5/2), £304; G1 (88/10/2/½), £374; (88/10/2/1), £360.

Phosphor Bronze.—BS1400, PB1 (AID released), £382 per ton.

Phosphor Bronze Strip, etc.—Strip, 467s. 9d. per cwt.; sheets to 10 w.g., 491s. 3d. per cwt.; wire, 4s. 9½d. per lb.; rods, 4s. 2d.; tubes, 4s. 0½d.; chill cast bars: solids 4s. 3d., cored 4s. 4d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 0½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 5½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 4½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £108 0s. 0d. Nickel, £519 0s. 0d. Aluminium, ingots, £163 0s. 0d.; aluminium bronze (BS1400), AB1, £341; AB2, £351. Solder, brazing, BS1845, 2s. 10d. lb.; granulated, 3s. 2d. lb.